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SEWERAGE OF NEW YORK CITY.

The following apt remarks on the sewerage of this city, are from the admirable message of Mayor Opdyke:

The importance of a proper system of sewerage cannot be over-estimated, as upon it depends in a large degree the health and comfort of the inhabitants of large cities.

Perhaps no city in the world is more favorably located than our own for a well-devised system of drainage. The natural formation of the soil, and the close proximity of the rivers surrounding the island, greatly facilitate the construction of sewers. To these natural advantages may, in a great degree, be attributed the absence of a regular system, which characterizes the sewerage of the lower and more compact parts of the city, and which have enabled even badly designed sewers in these localities to do their work with tolerable efficiency.

The evils arising from this want of system are, however, very apparent and constantly increasing. With few exceptions the existing sewers have been constructed in detached pieces, as applications for them have been made to the Common Council, their length and direction being controlled by the petitioners themselves, with little or no regard to ultimate consequences. It thus frequently happens that the drainage of adjacent though distinct basins are united, and a sewer originally of sufficient dimensions for the proper drainage of one of these areas, becomes taxed beyond its capacity—the adjacent cellars are overflowed and claims against the city for damages ensue.

Applications to the Common Council for the reconstruction of overburdened and defective sewers are frequent.

Two cases of this kind only need be cited, in which the relief demanded has been granted, at an expense to the City Treasury of upwards of $33,000. In consequence of the incapacity of the sewer in Madison avenue, north of Twenty-sixth street, the basement of the buildings on its line were flooded during periods of heavy rain. To remedy the difficulty, a new lateral outlet was necessary, and was constructed by the city at an expense of about $12,000.

The sewer in Eighth avenue, north of Thirty-fifth street, required a new outlet for precisely similar reasons, and this has been recently completed at an expense to the city of upwards of $21,000.

The neglect of a proper system has forced the rebuilding of many of the London sewers at an enormous cost to the city. Similar difficulties have been found in the sewerage of other large cities, and have been and still are remedied in a similarly expensive manner. We should take advantage of information thus acquired, of experience so dearly bought by others, as well as ourselves, by adopting at once such measures as may be practical for devising and perfecting a system of sewerage for those portions of this island as yet unprovided with sewers, and which, but sparsely built upon now, will in a few years rival in population the elder and more densely inhabited parts of the city.

A proper system of sewerage follows, with little deviation, the laws governing the motion of fluids—the area to be drained determines the dimensions of the main outlet and its branches. Sewers thus constructed are more efficient in their work, cheaper in first cost, and less expensive in repairs and cleansing.

Our sister city of Brooklyn, and the more distant city of Chicago, afford examples in this respect which we, with great propriety, may follow. They have each matured and carried into effect a general system of sewerage which cannot but promote in the future the interests, convenience, and health of their inhabitants. That we may also reap similar benefits, authority should be given to the Croton Aqueduct Board, with its present able and experienced Chief Engineer, to undertake and complete, at the earliest possible day, the necessary surveys, and to prepare in duplicate such drawings and plans as in their judgment are required.

These maps or plans would show in detail the respective drainage basins, the dimensions and flow of all sewers required in the future, and the lines or grades on which they should be built. They will serve as a guide to property owners in framing their applications to the Common Council, and will also enable the Committees to which such applications may be referred to determine with accuracy the propriety of granting or refusing the same.

The expense of these preliminary works is but trifling compared with the outlay incurred in remedying the defects in the two sewers before referred to, while it may save the city from much greater expense hereafter. An appropriation of $5,000 will, it is believed, be sufficient for the work recommended

PETROLEUM ITEMS.

QUANTITY OF PENNSYLVANIA OIL EXPORTED FROM PHILADELPHIA IN 1862.—The following table shows the quantity and value of Pennsylvania oil exported from the port of Philadelphia during 1862, the valuation, and the countries to which the articles were exported:

	Gallons.	*Value.*
British North America	1,000	$250
Barcelona	1,015	228
Antwerp	220,806	31,990
Great Britain	2,084,830	428,158
Havre	211,385	40,486
Marseilles	73,303	19,315
South America	1,798	901
West Indies (British)	3,848	1,722
" " (Spanish)	18,218	12,424
Total	2,607,203	$529,575

The following shows the monthly exports from Philadelphia:

	Gallons.	*Value.*		*Gallons.*	*Value.*
January	254,505	$53,290	July	272,450	$35,994
February	3,686	1,785	August	156,120	26,088
March	369,094	89,570	September	385,904	55,447
April	145,575	25,730	October	185,757	33,557
May	192,462	29,519	November	264,100	70,997
June	97,375	11,963	December	280,905	85,655
Total				2,607,203	$529,575

VALUE OF OIL FROM THE VENANGO OIL REGION.—The value of the oil thus far obtained from the Venango Pa. oil region is estimated at $4,000,000, yet the producing territory is but some eight miles long, with an average width of less than forty rods. The present daily yield of the Venango oil wells is about 4,000 barrels, and the value of this, at present prices, is $25,000.

DESTRUCTION OF AMERICAN APPLES BY PETROLEUM.—Owing to the large crop in America, the importation, both by steamers and sailing vessels, of this delicious fruit at this port is unprecedently large; and, for desert purposes, American apples have quite superseded the English fruit. The largest and finest flavored American apples may now be purchased in our markets at twenty-four for a shilling; and, at that low figure, the sales are not so large as might be anticipated. Last week, not less than 1,256 barrels were reported at the Custom House, and this week the arrivals are also large. A fact which has recently transpired should serve as a caution to shippers in America. The ship *Afton*, Captain Souper, took on board, at New York, 250 barrels. These were stowed in the hold, in which there were 1,800 barrels of petroleum—the offensive character of which is now notorious. The odor of the oil, as might have been expected, penetrated the apples, and the consequence was, that 244 barrels had to be thrown overboard, as, had they been brought to Liverpool, they would have been worthless as an article for sale, and might have exercised a very serious effect upon the health of many persons; and Captain Souper exercised a wise discretion in getting rid of them as soon as possible.—*Liverpool Post.*

PRICE OF COAL IN THE OIL REGION.—The Oil City *Register* says: "We are now paying here from thirty-five to forty cents per bushel. With coal banks within ten, and in some cases six miles from us, where teamsters can procure the coal for four and five cents per bushel, this is scandalous."

PRICES OF CANADA OIL.—The Oil Springs *Chronicle* of Jan. 1st, quotes prices as follows:

Crude 50 to 75 cents per barrel at the wells. Refined, 1st quality, 35 cents; 2d do., 30 cents; and 3d do., 25 cents per gallon, packages extra. Good oil can be bought at 30 cents. Buyers should be extremely cautious in purchasing, as there are many extemporized concerns here in which attention is directed more to the quantity than to the quality of oil manufactured.

PETROLEUM *vs.* POLE-CATS.—A writer in the Philadelphia *North American* says:

"Coal-oil, that in its crude state is as dangerous as gunpowder and as offensive to the senses as the odor of a pole-cat, is one of the greatest innovations of modern times."

There is no accounting for tastes, but we would rather have *several* barrels of petroleum in our cellar, than one barrel of gunpowder, or one pole-cat. The writer of the above must think that "comparisons are *odorous*."

GAS-LIGHT HEAD-DRESSES.—A new feature in the application of gas to domestic purposes is said to be on the point of introduction here.

Fire-flies of gold and brilliants already sparkle upon the graceful white feathers and fresh green leaves that adorn the brows of some of our youthful queens. Clusters of diminutive gas-lights are now to spring from the elaborate tresses of beautiful matrons; the jets will issue from burners measuring a twentieth of an inch per hour, within transparent shades exquisitely cut, not larger than a cherry. The tubing is to be of solid gold, connected with a reservoir of the same valuable metal, which is to lie concealed in the meshes of luxuriant hair behind the head. The pressure will be applied to the golden tank, which is supported by an elaborate back-comb, the top of which forms a row of little gas-lights. Before entering the ball-room, the husband will "turn on the gas," light up his blushing bride, and usher her into her sphere of conquest, revolving like her prototype the moon among the lesser lights around. When the apparatus is completed, we will present it more fully to our readers.

GRAND GAS-LIGHT COMBINATION.—In an early number we shall give a succinct statement of the great gas-light combination on this Island, together with a map showing the district of each company. The Island of New York is completely possessed by the four gas companies, whose united forces present an array of wealth and power not equalled in any other place in the world.

PAPERS ON HYDRAULIC ENGINEERING.

By Samuel McElroy, C. E.

No. 3.—Pumping Engines.

[From the Journal of the Franklin Institute.]

(*Continued from page* 164.)

Force Lift.—Under this head we may consider the action which pertains to pumps, independently of the suction lift, with some preliminary allusion to the different classes of pumps.

Pumps may be divided into two general classes; those which are *single-acting*, in delivering a single charge by a revolution or double-stroke; and those which are *double-acting*, delivering a double charge, for each revolution or double-stroke.

Single-acting pumps may be divided in two general classes; *bucket* pumps, and *piston* or *plunger* pumps; of these the first operate in one direction only, and the second operate in one direction on the suction lift, and in the other, on the force lift.

Bucket pumps are to be found in the lower lifts of the Cornish mines, supplying the first cistern for the plunger lifts. They have the advantage of being more readily lowered to suit the changes in level of the well, and the buckets can be drawn out for examination and repacking through the delivery pipes, in case the pumps should be flooded. The leather packing used, seems to be defective in requiring frequent renewals, varying from a few days to two or three months. The several lifting pumps of the large Haarlem Meer engines, are of this class, the buckets being attached by chains to the rods, with butterfly valves, which lift on the hinges about 1.5 inch in descending. Each pump of the Brooklyn engine is also single-acting, in which the valve is a "double-beat" playing on the rod; an application which we believe to be original, and which works admirably. The pumps of the New York Dry Dock engine, and others of the kind, are single-acting, and there are single-acting buckets in compound pumps as in the case of the Hartford engine. The common hand pump belongs to this class. In some of these cases foot valves are used, and in others their use is superseded.

Single-acting piston pumps are used in some of the mining engines at Bavaria, one of which has a lift of 1,168 feet; at the Huelgoat mine in France, with a lift of 754 feet; at the Boulton and Watt engine, East London Water-Works, the Wolverhampton engine, and others in various places. In these cases the pump chamber is placed on one side of the pumping main, while the foot valve on the suction tube, with the delivery valve on the forcing tube, are above its upper centre. At Huelgoat these valves are on the common centre line of the main, so that except the current into the pump chamber on the descending stroke, which makes the suction lift, and the return current on the force lift, the line of delivery is not changed. At East London and at Wolverhampton the pump chamber stands between the suction and forcing tubes, the lines of delivery being abruptly changed in direction, at the pump head.

Single-acting plunger pumps are used in the upper lifts of the Cornish mines, in the single-acting water-works engines, and in some which are double-acting. The suction lift is made on the up-stroke, and the force lift on the return stroke. In the mining engines the valve-chest is in the centre line of the main, as in the Huelgoat main, but in the water-works engines, the foot valve-chest is generally placed below the plunger, the current turning with a right angle into the delivery valve-chest above and on one side of it, passing thence by a goose-neck turn into the air-chamber or stand-pipe base, making three right-angled changes of direction, in addition to the pump current. In the mining pumps the lifts are usually from 180 to 240 feet each, the whole discharge being made into a cistern placed at each station, from which it is redrawn and reforced, lift by lift to the summit, which in some cases is 1,300 feet above the well.

Double-acting pumps are used with both pistons and plungers—vertically, inclined, and horizontally—plungers being exceptional to the general practice.

Horizontal or inclined piston pumps, with suction and delivery side-pipes, fitted with metallic or rubber clack valves, are the most common. There are several specimens at Philadelphia, Pittsburgh, and other Northern, Southern, and Western cities, worked by cranks from a fly-wheel shaft, or by a half-beam. In the Spring Garden engine-house there are two engines with a double-acting vertical pump under each cylinder, worked by the piston rod prolonged, in a fly-wheel beam engine. At New Orleans two beam engines work vertical pumps, in which the water valves are controlled by eccentrics.

At Charleston and at Cambridge horizontal plunger-pumps are in use, with a diaphragm in the pump-chamber, which provides for double-delivery, the plunger being worked by a rod passing through a stuffing-box. The valves are small India-rubber clacks on a grating, the delivery-tube being attached to one side of the pump-chest. A modification of this plan retains the advantage of plunger-packing, by dispensing with the diaphragm and separating the pump-chambers, so as to use two stuffing-boxes on the same plunger.

The pump usually known as the "Ditton" pump, is double-acting so far as it combines both the plunger and the bucket in the same barrel, but it is single-acting so far as it delivers at one revolution only the charge due to its bucket area and stroke. Here the plunger is made half the area of the bucket, which is attached below it; the foot valve retains above it, on the down stroke, the charge drawn up by the bucket on the up stroke, of which one-half is forced into the main by the descending plunger, and the other half by the bucket on the return stroke; in this case the forcing load on the bucket is in part counterbalanced by the load on the plunger area, while it carries the whole suction load.

Before comparing these various systems, we may refer to the relative merits of the details of plungers, pistons, and buckets, valves having been already discussed.

The general adoption of the plunger with its stuffing-box, as invented by Sir Samuel Morland, in 1675, or rather improved on much more ancient use, has led to the assumption that its advantages are peculiar to itself. While it is claimed to have less friction, its facility of access, inspection, and repair, is important. As compared with the piston or bucket pump, in point of construction, there is a choice between boring a barrel or turning a plunger, the amount of metal used being in excess for the latter, but the plunger pump is the most simple; as to the relative friction, this is determined in either case by the amount of rubbing surface and the pressure, and therefore, except the stuffing-box of the piston rod, may be no more in one case than in the other; if the exposed stuffing-box on one hand admits open inspection and nice adjustment, the exposed piston (single-acting) also admits this, and may easily carry a movable stuffing-box. The enclosed piston or bucket, which was discarded for its rudeness in the mines, as to its valves and packing, may be brought up to a high standard of efficiency by careful workmanship, so as to need no repacking for months and years, as at Spring Garden and Brooklyn. There is the disadvantage that cases of leakage are not immediately apparent, and cannot be remedied with an engine in motion. So that, in fact, as is generally the case in machines, correct workmanship and careful supervision really determine the matter, and may attain satisfactory results in either way.

Of these pumps the several classes of movements may be thus specified:

The Pittsburg arrangement on each stroke makes an abrupt turn from the suction tube or side-pipe, through the valve-chest into the pump-cylinder, reversing the motion on the return stroke. The passages are contracted and the valve openings small, while the motions are arbitrary and irregular, as taken from a crank. Hence there is much friction and the concussions are formidable.

The Ditton pump also takes its motion from the connecting rod of a crank engine, the result of which will be noticed under the head of *engines;* and while the lines of delivery are at right angles to the pump, the supply at each stroke is crowded past the plunger in such a manner as to involve considerable friction. If the plunger be enlarged so as to counterbalance the load on the up-stroke, the freedom of delivery is the more restricted. The friction due to both the plunger and bucket packing is encountered.

In the East London piston-pump, as at Wolverhampton, the current from the suction-tube is reversed by the piston, re-reversed on the return up-stroke, and passes through the abrupt turns of the delivery valve-chest.

In the single-acting water-works engine the lines of motion are thrice changed in entering the force-main, and the valve openings are somewhat restricted in practice, but admit of increase.

In the Huelgoat pump, as in the plunger mining-pumps, the current has the reverse due to the pump only, the suction and forcing tubes being in the same line, and large valve-openings being admissible.

In the Cambridge pump, which is worked by a direct horizontal motion, there is nothing to prevent a direct line of delivery, as in the Huelgoat or mining-pump, or the use of equally valuable valves, except that the rapid motions due to a short stroke interfere with their use. As built the delivery is not direct.

In the Hartford pump two lifting-buckets are worked by spiral cams on the pump-shafts, in each of four vertical barrels, in such a manner that the suction or forcing charge of one bucket is passed through the other, which is not in operation in descending; that the working speed is slower than the return stroke; and that in transferring the load from one bucket to the other they both travel together for about one-twelfth of the stroke. This is an ingenius modification of an old arrangement, if we assume that the result, in equable delivery, could not have been more simply attained with much less friction. A modification of this idea, and of an ancient device, was adopted for the new Detroit engine in using two telescope barrels fitted with bucket-valves, which worked by spiral cams alternately towards and from each other. The engine itself did not pass acceptance, but the pump was much simplified in the use of a single delivery, without change of line, one of the errors at Hartford being the multiplication of small pumps and gearing, and the changes of line in supply and delivery.

In the Brooklyn engine the pump dimensions are large. The forcing charge of the lower bucket, under the cylinder, is carried by two right-angled turns through the upper pump, and thence by a third turn into the main, an action assumed by the upper bucket on its lift; freedom of delivery being favored by annular pump barrels outside of the working barrels, fitted with double-beat covers. In this case the lines of motion are not reversed, and there are no contractions in the flow.

In the pumping arrangements of which these are representatives, we find not only single-acting pumps worked by single-acting cylinders, which take steam one way and make the return stroke by counterweights, but we find double-acting cylinders working two or double-acting pumps in combination with the same main, as we also find them working double-acting pumps.

We also observe, in respect to delivery, that in single-acting pumps but one-half the quantity of water is delivered per double stroke, due to double-acting pumps, and that but one of the latter is usually worked by a cylinder, in practice, the double-acting cylinder and pump being equivalent in power to the same cylinder with two or more single-acting pumps.

Resuming, then, our leading subject of force-lifts, from this notice of pumps, intimately connected with it, we find that the relations of the suction-main on one side, the intermediate pump, and the forcing-main, are controled by mutual laws of action and arrangement, which affect maximum results.

It may be taken for granted, that in dealing with a heavy, incompressible, mobile liquid like water, losses from friction, counteraction, and otherwise, are unavoidable, and that the problem of effect depends on their reduction to a minimum. The expensive construction, the concussions, accidents and repairs of pumping machinery of all kinds sufficiently illustrate the importance of this problem, and explains, to a certain extent, the endless varieties of machines which have been devised, and the differences of opinion as to practical remedies and results.

The proportions of a pump are adapted to the required delivery in a given time, and the assumed speed; those of the engine are adapted to the required load and speed, which measure the mechanical work. As

the mains are generally long, and rapidly increase in cost with increased diameter, their size has considerable influence on the relative pump area, while the length of stroke is determined by convenience of engine construction and a certain assumed speed.

In water-works, the item of present and a certain prospective demand, as a representative of annual income, regulates, or should regulate, the question of outlay in construction. As to the pumping main, this item of allotted capital and delivery should determine the calibre. The pump should be proportioned to the main, as to area; the speed to the rule of bad practice in strokes per minute, fixing length of stroke, and the engine dimensions determined from the pump load and speed. But as a rule, we find proportion much neglected between pumps and mains, and arbitrary proportions adopted for the engines.

Imperfect pump-action is caused by frictional losses, counteractions, resistances and loss of charge, aggravated by conditions of speed, travel, concussions and irregular engine motions.

It may be taken as a rule that the pump diameter should never exceed that of the main; that the most perfect valves and most free opening are advisable; that all reactions in line of current motion are objectionable; that all changes in direction of supply and delivery are to be made as simple as possible; that the pistons, plungers or buckets are to be carefully made and packed to prevent leakage on one hand, and excessive friction on the other; that arbitrary movements during the stroke are to be avoided; that the greatest length of stroke is desirable; and that the impulses to the delivery-column should be regularly maintained without material pauses in action.

From the established law in flow of tubes that all contractions are sources of loss, the propriety of adapting pump diameter to that of the connecting tubes is apparent, not only from the frictional loss, but from the change of speed in the water-flow. Any dierence between the rate of flow in the pump and main has an importance beyond that simply of the *vena contracta* in influx and efflux at the pump-chamber, or of valve friction. Enlargements are less objectionable than contractions, in the pump or main, but also produce reactions.

Changes of direction in line of flow cannot be usually avoided, and produce certain comparative frictional losses, but they are far less objectionable than reactions, or reverses in motion, which more directly affect and embarrass the *vis viva* of the water column.

Some of the operations of the water column will be more clear by examination of certain laws of motion.

The several classes of reciprocating pumps we have presented, represent two distinct doctrines of motion; one, which claims that maximum effect is to be produced by the most uniform flow of the column, and the other, that maximum effect, *cæteris paribus*, depends on a uniformly variable flow.

Uniform Motion.—The first school assimilates the force-main of a pump to the discharge-main of a reservoir, and objects to all abrupt or alternate changes of head, as far as attainable, regarding continuous flow as equally necessary in either. In accordance with this aim, we find the several combinations of pumps to a single main in frequent use, the entire class of short stroke pumps, and the use of cam motion.

In the case of pumping arrangements which have been urged with great pertinacity, have been constructed and made the subject of very costly experiments to obtain a continuous current, it is represented that in this way economical results may be attained far surpassing those of any other class; that the valves may be made to open and close without noise or concussion; that the use of stand-pipes, air-chambers, or fly-wheels, may be dispensed with; and that all frictional losses are brought to a minimum. The following language has been used on this point:

"A column of water that is passing through an ascending main from a pump that in fact produces a continuous flow, really becomes a fly-wheel to whatever machine may be used to furnish the power for driving the pump. If this machine be a reciprocating engine, this same fly-wheel, which the column of water may be called, becomes a regulator of the engine, and furnishes the means of carrying the principle of expansion to the greatest limit, and of using power with useful effect to an extent that cannot be exceeded in its application to any other work."—*Detroit Water Works Report*, 1856.

It was also represented that the pumps would deliver more than their theoretical contents per stroke.

The arrangement to which this report specially refers, and which has been described under "single-acting bucket-pumps," was guaranteed to perform a duty of 1,000,000 foot-pounds per pound of coal, and was put under contract July 19, 1856, to be completed July 1, 1857; but as its construction was delayed until the spring of 1861, and the engine was then abandoned by its builders, these mechanical results have not been demonstrated.

The Hartford engine furnished the experimental basis of the theory under which this contract was made, the Belleville pump duty being reported 718,013, 685,634 and 739,138 ft.-lbs. on three trials of December 19th and 20th, 1856. The duty at Hartford was also reported, July 16th, 1857, at 655,054, and 689,745 ft.-lbs. on two trials.

Reports like these are interesting, even when they embody the proof of their want, in some respects, of method and reliability, and illustrate some of our former remarks. The city of Detroit has spent $25,790 on one experiment, and for the engine-house specially adapted to it $56,876, and now votes $25,000 for another engine. As the most prominent type of this particular school, the Hartford pump merits a closer description than has been already given.

Two vertical pump barrels are placed on each side of an intermediate horizontal force main, 16 inches in diameter, with which their deliveries are connected by a double goose-neck turning downward, the centre of the tube being about 5 inches above that of the pumps. Each barrel is made with two diameters, the upper chamber, 19 5-16 inches, the lower, 18¾ inches, taking two buckets fitted with butterfly valves, which are seated at an angle of 45 degrees. The lower bucket is operated by a rod 3⅛ inches diameter, which passes through the sleeve rod of the upper bucket, 4⅝ inches diameter (external), and is attached to a separate bell-crank. The pump motion is caused by bell-cranks operated by spiral cams from two geared shafts, reducing the engine speed, in the proportion of 80 to 27. The effective stroke during a revolution is 32¼ inches, or 16⅛ inches for each bucket, the actual travel being 35¼ inches, and the speed of each pump in delivery was 8 158 strokes double or 21.92 feet per minute, or 87.69 feet in all four, that of the force-main being 112.19 ft. The engine is condensing, with a fly-wheel, and with a cylinder of 5 ft. stroke and 32⅝ inches bore, making 24.25 revolutions per minute, under an average piston pressure of 8 373 pounds. The equivalent pump lift was taken at 138.34 feet, length of main 6,879 feet.

Measurement made at the reservoir with great care, for the experiment of December, 1856, showed a loss of action (or a difference between theoretical and actual delivery) of 6.56 per cent. in the pumps. This settled the argument of surplus delivery. It was also shown during that and other trials, that the small air-chamber which is placed on the main near the outboard pumps, had a very important effect on the smoothness of the pumping action and could not be dispensed with, nor could the speed of the pumps be increased, without producing concussions in the barrels.

With an arrangement of this kind, subdivided in eight working parts, which move together about one-twelfth of the time, each with slow speed, built with the most solid foundations and most careful workmanship, it might be assumed that this doctrine has a most favorable development, and uniform flow would be readily attained, with all its benefits. But the pressure pump card given in Plate II, from one of these pumps, and repeatedly duplicated by the indecator, goes to show conclusively that the doctrine is at fault. It must be remembered that in this case there is no cessation to the lifting movement or to its uniformity; that each bucket relieves the other of its load, alternately; and that the lifting speed is much more moderate than the inoperative return stroke. The pump location is also low, being but 9.28 feet above the well, at the centre.

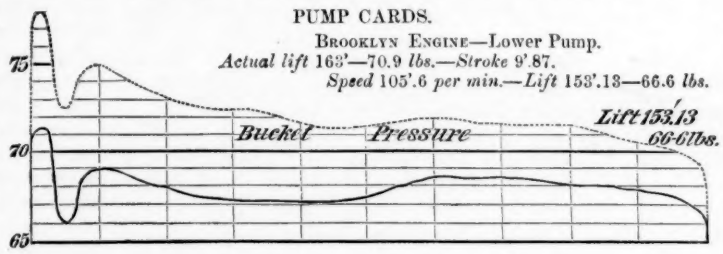
The card opens with a pressure of 61 lbs, as a wave of oscillation, which decends to 47.5 lbs., and then returns to about 53 lbs., from which during the stroke it gradually falls to 49 lbs. If we admit that a part of the oscillation is due to the momentum of the indicator piston, it cannot be claimed that this explains more than a portion of the evident wave as an effect of fresh impulse at the stroke commencement. The card clearly shows the distinct effort of each bucket to put its special charge in a certain motion, and the surplus initial power it is required to exert in order to accomplish this result, and it shows that the *vis viva* of this

PUMP CARDS.

Brooklyn Engine—Lower Pump.

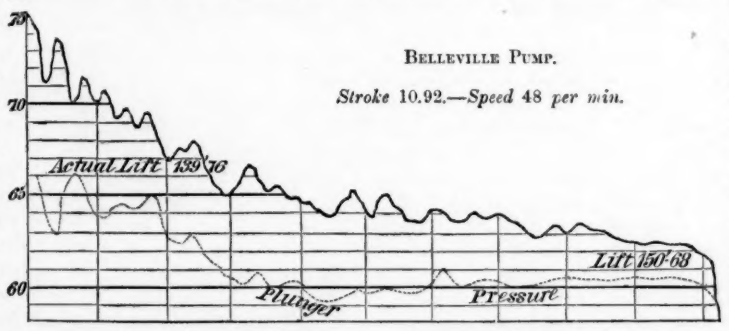
Actual lift 163'—70.9 *lbs.*—*Stroke* 9'.87.

Speed 105'.6 *per min.*—*Lift* 153'.13—66.6 *lbs.*



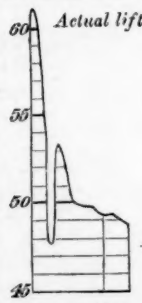
Belleville Pump.

Stroke 10.92.—*Speed* 48 *per min.*



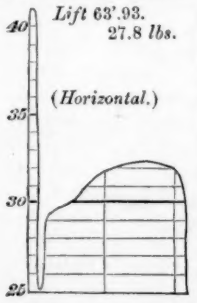
Hartford Pump.

Stroke 16.12 *in. Speed* 21.'92.



Cambridge Pump.

Str'ke 26.17 *in. Sp.* 33'.8.



under certificates of several engineers of "reputed skill in their profession." In November, 1855, an experiment at Hartford gave 423,439 ft.-lbs. pump-duty, and on the Belleville Cornish engine 846,277 ft.-lbs. Another experiment at Hartford, December 14, 1855, gave 584,704 ft.-lbs., and, deducting coal lost in getting up steam, 974,195 ft.-lbs. A third experiment gave 487,783 ft.-lbs., May 1st, 1856, and at Belleville, 513,-295 ft.-lbs., which was reduced for "effectual duty" to 461,966 ft.-lbs. It was also calculated that the superior evaporation of the Belleville boilers entitled the Hartford pumps to an actual relative duty of 720,125 ft.-lbs. It was also certified by the experts of the last trial, that no air-chamber or stand-pipe was used, and that the pump indicator "did not perceptibly move during the trial, but gradually registered a greater pressure as the head of water was increased in the reservoir." As the contractors represented in the meantime, the opportunities of improvement over the objectionable gearing and arrangement of this engine, and a willingness to guarantee 1,500,000 such ft.-lbs. as those of the Jersey City engine, their contract-guarantee of 1,000,-000 ft.-lbs. was not considered unreasonable.

In further experiments at Hartford the pump duty was made 550,681 ft.-lbs., December 5th, 1856, and 626,617 ft.-lbs. December 5th and 6th, on another trial,

charge, reduces the load at the end of the stroke 4 or 5 lbs. less than the mean of the initiative motion, and about 10 lbs. less than the actual primary impulse. This settles the question of uniform velocity under eight sub-divisions of impulse, each travelling but 21.92 feet per minute, assisted by the resistance of a force-main contraction, and by an air chamber.

With two suction tubes of 16 inches diameter, the average load was 6.85 lbs. or 15.75 feet, while the actual average lift was about 9.28 feet, the variation during the lift being not less than 1 lb. in favor of the final load. The doctrine of uniform motion and load is then also at fault on the suction lift, and the pump location is demonstrated, as in other cases described under the head of "Suction," to be too low. With such results as these in a typical arrangement, it cannot be contended that short continuous strokes have any special value in uniform flow. Its advocates have no better resource than an improvement of the rotary pump. Nor is any proof furnished here of advantages in combinations of pumps.

As a second illustration of the effect of short stroke pumps, we give a card from the inner pump of the horizontol Cambridge double-acting engine, which was then making 40 strokes per minute. In this case, as noticed, the plunger acts through a central diaphragm. Here the initial effort to propel the charge carries the pencil up to 41 lbs. from which it returns at once to 25 lbs., thence to 30, rising at the first foot to 32, at the second to 32.5, ending the stroke at 30 lbs. The card shows a blow and a reaction, which is in part due to the engine arrangement, with light working parts, and with an annular cylinder of Simm's pattern, in which a uniform pressure is attempted through combined high pressure and expansion; but the manner in which the initial effort is made, and its necessity, is nevertheless clear, as to the pump charge, as well as the absence of either uniform pressure or resistance.

Uniformly Variable Motion.—On the other hand, distinguishing between a supply-main in which the flow is maintained by the force of gravity, and a force-main in which impulse must overcome gravity, it is assumed that each particular stroke of a pump is, in a very important sense, an independent effort. This is true of all reciprocating movements to a greater extent than is generally supposed, and with regard to fly-wheel, steamboat, and locomotive engines, not less in principle, than the direct-acting and non-rotary. Each particular stroke of the most perfectly balanced fly-wheel engine should contain a perfect measure of impulse and resistance, and the whole class of governors only illustrates the relative necessity and harmony of these conditions of motion, in which surplus initial impulse, and reduced final impulse, are unavoidable laws of each reciprocal piston movement.

In harmony with this principle it is also held, that it is impossible to disturb the equilibrium of the particles of a liquid like water, as of any fluid, by impulse, without producing a wave, which in the case of the stroke of a pump piston, becomes a wave of translation rather than of oscillation; this theory harmonizes with the natural tendency of water to undulation, under circumstances which peculiarly affect its large percentage of air, and develope its exquisite inobility, while its gravity is being overcome, and avails itself of a law of common observation.

In brief, then, it is held, that each pump stroke at its commencement and earlier stages, imparts motion to a body of water equivalent to its charge, which charge has a natural tendency to produce a distinct wave of translation; that such stroke must exert a certain surplus impulse during a certain stage of its travel to create this wave, which surplus is compensated during the stroke in whole or in part, as proper circumstances admit, by the *vis viva* of the charge; that the maximum useful effect is determined by the smoothness with which this wave is created, and the facility with which its translation is accomplished, the power being transmitted at one period by an accelerating motion, which is retarded in completing the stroke; and that in a representative curve combining power and velocity, the greatest ordinate would precede the half stroke. It is also held that in every force-main there is a wave of maximum effect, which cannot be retarded, accelerated, or disturbed by irregularities of impulse without detriment, and defines a uniformly variable motion.

Under this theory, the pump area being adapted to that of the main, its length and speed of stroke become important; the former in order that all the benefits of impulse and *vis viva* may be attained, and the latter that the gradations of impulse may harmonize with the natural motion of the charge, during the effective part of the stroke. Too rapid an initiative is to be avoided on one hand to prevent concussion, and rapid acceleration from the iniative is to be secured on the other, avoiding all acceleration after the wave has passed its impulse, as waste of power. The ordinary mechanical doctrines of inertia, of impulse, and of momentum, have, in this theory, a simple and plain reiteration, and in its experimental results, a beautiful demonstration.

In the cards of the Belleville single-acting plunger, intermittent, and of slow speed in its stroke, and of the Brooklyn single-acting bucket, non-intermittent and rapid in speed, this principle of pulsation is effectually demonstrated. Standing on the reservoir bank of the Belleville heights, the bell-mouthed vent of the main is seen several feet above the usual water level. As the impulse is imparted from each pump stroke, a sheet of water arises with accelerating speed and pours over the level edge with a sound which defines its varying power, gradually dying away as the wave exhausts itself, and the lip of the vent becomes again dry; a process distinctly repeated with each pump stroke, at a distance of 2,359 feet from the delivery valve, in a tube at the time unprotected by either air-chamber or stand-pipe. At the vent of the Brooklyn main, 3,450 feet from the pump, these pulsations from the speed of flow and horizontal delivery, are less clearly defined, but may be distinguished by the ear, and at slower speed are more evident. Their law of motion is sufficiently evident from the card.

At Belleville, the counterweighted plunger detached, in one sense, from the cylinder, descends on its force lift. Its initial speed is slow and embarrassed, until its column is started, which is effected through the first and third of the stroke, and then occurs the anomaly that although its relative lift increases with its descent, its resistance actually decreases, from 65 lbs. at first, to 60 lbs. at 3.5 feet of its whole travel of 10.92 feet; we also see that the column has so effectually received its impulse that the delivery valve shuts down at 10.16 feet of its travel; so that the equivalent load at starting is 149.5 feet instead of 139.76, and at 10.16 feet descent it is 138 feet instead of 150.

The Brooklyn bucket commences its lift with a theoretical lift of 163 feet, and an actual load of 174.8 feet, ending with a theoretical load of 153 feet, and an actual of 161 feet, the reduction in lift being about 10 feet, and the practical reduction 13.8 feet.

Here the maximum impulse has been imparted at about 3.5 feet of the stroke, the resistance rapidly diminishing after the eighth foot, and while this card illustrates the effects of a continuous application of uniformly variable impulse, as distinct from the intermittent strokes of the other, both cards show beyond question the law of motion due to each pump charge and its proper conditions of motion. The same law has been already demonstrated in the suction cards, given in the last number, wherein the Belleville pump shows a final stroke reduction of 7 lbs. from the maximum load, and the Brooklyn pump a reduction of 3 lbs. The aggregate effect shows, then, in the first case, a range of 12 lbs., and in the second of 9 lbs., between the initial and final parts of the stroke.

It is a matter of deep interest and importance to determine the conditions of area, speed, and length of stroke in pumps, as they are affected by these established mechanical and natural laws, and merits a serious and continued experimental research by the the profession. Experiments with the Brooklyn pump indicate very clearly the connection between a given speed and a maximum effect, and in time it will undoubtedly be demonstrated that every pump develops a uniform law of effect in these respects.

This wave of translation involves an effect which is erroneously claimed for the principle of uniform velocity, in facilitating and regulating the engine stroke. It is impossible that a strictly uniform motion should act as a fly-wheel to an engine, since it would prevent the storing and rendition of power, from the commencement to the end of the stroke, essential to true reciprocal motion, under the law of mass in motion, by which cylinder expansion is attained. This wave, which in its formation receives the whole power of the initial impulse of the piston, in turn becomes an easement of the central and final portions of the travel, preventing injurious concussions on one hand, while it relieves the terminal stroke on the other; a condition which is beautifully illustrated in the cards given, and especially in the action of the Batavia and Huelgoat pumps, and the large engines of the Haarlem Meer and Brooklyn class. In single lifts of 754 and 1,168 feet, the production of this wave is the key to harmonious action, and the very condition of safety. Precisely the same operation is true of the counter-weighted plunger on its steam lift, as Pole has demonstrated, and of every fly-wheel, and of every steamboat wheel, as the crank-index of the splendid Sound steamer *Metropolis* reiterates with every revolution. Uniform motion is a mechanical myth in practical dynamics and hydrodynamics. It is impossible for any pump piston to make a stroke without exerting at the outset a certain surplus pressure to overcome the inertia of its working parts and its charge, which it must be repaid during the stroke to realize its maximum effect, and on the manner in which it exerts this surplus initial pressure, will depend upon its smoothness of action. The relative effects of crank and direct actions will be noticed in this connection under another head.

Loss of Action.—From joint and valve leakage, presence of air, currents, and other causes, no pump will deliver its theoretical charge. Experiments on record show that this loss of action may reach a formidable extent, and it is obvious that perfection in construction as to lines of supply and delivery, valves, &c., and in operation, is important in this particular, as promoting the most complete charge to the pump chamber. Some Cornish plunger pumps show about 7 per cent. loss; those of the Pittsburgh class show 14.7 and 16.3 per cent; the loss at Haarlem Meer is 10 per cent.; at Hartford, 6.5 per cent.; and at Brooklyn 1.65 per cent. These varied results illustrate the importance of correct workmanship and action, and in less perfect pumps probably range beyond 30 per cent.

It is contended by some hydraulic engineers, that the mechanical work of a pump is the same whatever may be its loss of action, and that the product of the pump diameter into the lift, measures the actual duty. We think it very plain, however, that the evident concussions shown on the annexed cards, are produced by the action of the piston in striking solid water, which virtually reduces the length of pump stroke and gives a certain travel without resistance; and it is also plain that the only resistance to the leaky portion of the piston is that due to the friction of the lost current in passing it, on the perimeter of the leak. If the piston were to leak the entire pump charge, the delivery valve would remain on its seat, and the engine load would be represented by the piston friction alone, and whatever part of the pump is unfilled certainly prevents effective travel.

Combined Pumps.—Among other processes for obtaining uniform delivery, it has been customary to combine several pumps with a common main, and with varied centres of motion. Some very curious devices of this kind have been strongly urged, and occasionally put in operation. It is evident, however, that if each pump stroke has its distinct acceleration and retardation in generating its wave of translation, that a discharge into the same main of a second, third, or fourth wave, under different times of impulse, must produce injurious counteractions. These are unavoidable in all such combinations, and are sources of direct loss of power, which experiment has clearly defined. In the case of blowing engines, and other connected stationary engines, as in the case of steamer engines, of which the *Great Eastern* is a notable example, one engine is always operating at the expense of the other, to a certain extent, defined by the mutual conditions of impulse and resistance.

In one extreme case which has come under our observation, the addition of a second steam pump to a force main, has increased the total delivery less than 50 per cent., while the coal account was fully doubled, and we have notes of experiments on large engines, where an increase of 14 per cent. in load is directly attributable to this counteraction.

Force Main.—This should be laid, as to diameter and directness of line, on the most liberal scale admitted by the standard of supply and demand, already referred to. The friction, which diminishes nearly as the square of the velocity of flow, is directly modified by increase of diameter, and also varies with the length, representing a constant co-efficient of work, which must be covered in the coal account. The relative friction, however, of a well arranged main is not a formidable item by any means, generally much overrated in engine-house locations.

All horizontal bends are to a certain extent objectionable, though much less so than vertical bends which permit the accumulation of compressed air, always a formidable resistant to water flow; contractions and expansions in form are also objectionable, as are all check-valves, although occasionally indispensable.

The experimental observations on force-main friction show the interesting fact that the formulæ determined for a fixed head and uniform discharge by the various authorities in hydronamics, are sufficiently applicable to the conditions of motion which have been presented, to warrant a full reliance on their correctness, and to demonstrate in certain cases an accuracy, with which they are sometimes discredited. The Brooklyn mains, of which one is connected with each engine, are 3 feet in diameter, 3,450 feet long, laid without vertical bends, with one curve of 800 feet radius, with two check-valves, and a conical adjutage. With a mean flow of 180 feet per minute, the actual loss of head is 4.71 feet; while the theoretical loss by the simple and elegant formula of Weisbach is

$$H = .0244 \frac{3450}{3} \frac{3^2}{64.4} = 3.92 \text{ feet},$$

leaving 0.79 feet to be accounted for in the check-valve and curve friction. This not only demonstrates the formula, but it indicates the law of motion of the pumps and tube, on the most powerful scale in the history of pumping engines, each of these engines being by some 21 per cent. the most powerful in use. Other cases exist, however, in which imperfect construction and action give the formula a negative endorsement, which is a valuable lesson.

The value of an air-chamber as a cushion to the pump stroke and main flow may be very strongly urged; its elasticity is perfect and its operation conclusive; and yet by a misapprehension of the original uses and purposes of the stand-pipe which specially belongs to the intermittent supply system of the European school, it has become customary with us to adopt a modification of it, in which the overflow is not used as in the old country, and a very rude, cumbrous, expensive, and inexcusable appendage is substituted for the convenient and effective air-chamber.

(To be continued.)

HISTORY OF WATER-GAS.

It is well known that water passed in the form of steam over red-hot iron, is decomposed; its hydrogen being liberated in the form of gas mixed with a little carburetted hydrogen from the carbon of the iron, while the iron becomes converted into oxide. If coke or charcoal be substituted for iron in this operation, hydrogen, carbonic oxide, and carbonic acid gases are produced in variable quantities, according to the temperature employed; carburetted hydrogen being only present in very small quantity, according to Dr. Fyfe. This mixture of gases is very slightly luminous, and consequently of little value itself as a source of light. It has, however, been proposed by numerous patentees, either as a means of diluting very rich illuminating gases such as those obtained from oil, resin, tar-oil, and cannel coal, or sometimes alone, at others in connection with the vapors of water, as a means of decomposing the tar vapors evolved from coal, fat, or resin, during distillation. Thus employed, the gases from water are said not only to mingle, and by their presence in the form of a current to drive the gases rapidly from the retorts, but to be instrumental in converting the vapors of tar into permanent gas, and preventing the large deposition of carbon in the retorts and pipes, which forms so serious an obstacle to the distillation of highly carbonized matters on a manufacturing scale. Both Drs. Fyfe and Frankland, who have investigated the action of the gases evolved from water in connection with the distillation of resin and coal, are agreed that no chemical union with the elements of the tar is brought about when the water-gas is introduced into a retort in which resin or coal is undergoing distillation, although they certainly prevent the large deposition of carbon.

Donovan appears to have been the first who employed the gases evolved from steam, in its passage over red-hot coke or charcoal, for illuminating purposes; and in order to confer upon these the necessary amount of luminosity, he caused them to combine, as he believed, with carbon in the state of vapor, or as produced from the distillation of oil of turpentine and the resinous parts of coal-tar or naphtha. This patent, which was secured in 1830, appears to claim something more than the mere impregnation of water-gas with the vapors of hydrocarbon or naphtha, although it is probable nothing further was really obtained by the processes recommended. In 1832 Lowe introduced his system of naphthalizing coal-gas in the manner described below, by which poor gas is rendered more luminous by being saturated with naphtha vapor. M. Jobard, of Brussels, took a patent in 1834 for passing the gases derived from the decomposition of water over resinous bodies while undergoing distillation; and with him appears to have originated the idea for which Selligue obtained a patent in France in the same year. Selligue's process was used in connection with shale-oil, and was most favorably reported on to the French Academy by Thénard, Darcet, and Dumas. It was introduced at the Royal Printworks, and extolled at the time by Payen.

The bituminous shale of Autun, as used by Selligue, affords, when distilled, from 10 to 20 per cent. of oily products, ⅔ of which consist of a light oil, of specific gravity 0.766 to 0.810, which was used for the production of gas. Three cylinders were employed in the process, set in an upright position in a furnace, where they could be heated to redness. Two of these were filled with wood charcoal, which could be replaced from time to time; the third was filled with chain and pieces of iron. A thin stream of water flowed into the first cylinder, and was converted there, in contact with the red-hot charcoal, into carbonic oxide and hydrogen, which process was completed in the second retort, from whence both gases entered the third retort, in which a stream of the shale-oil was being decomposed by the red-hot iron. The carbonic oxide and hydrogen gases from the water here mingling with vapors from the destructive distillation of the shale-oil, constituted the new illuminating gas. By the simultaneous decomposition of 157 lbs. of oil and 160 lbs. of water in this manner, 13,461 cubic feet of gas (of 0.65 specific gravity) are said to have been obtained,—and, moreover, of such a quality that its illuminating power was twice as great as that of ordinary gas: 86 cubic feet of this better kind of gas were, therefore, obtained from 1 lb. of oil, whilst the same quantity of shale-oil, treated in the usual manner, would only produce from 15 to 28 cubic feet. So extraordinary a result is quite incomprehensible, nor is it at all explained by the statements proceeding from the high authorities before quoted. The remarkable fact is mentioned, that in the third retort there is no deposition of carbon whatever upon the iron chain, and that, consequently, the gas prepared by Selligue's method must contain all the carbon that is deposited as graphite in the retorts by the ordinary process; they remark further, that Selligue's gas deposits no condensable vapors at 25° C., nor is it deteriorated in quality by that temperature; whence it appears that the value of the gas depends upon its chemical, and not upon its physical constitution; but no facts are given calculated to explain the chemical process concerned in its production. It remains quite inconceivable how the illuminating power of the gas can be doubled by the products of the decomposition of water, consisting, as they are known to do, of equal volumes of carbonic oxide and hydrogen; and even supposing the latter to be combined with carbon, yet the gas must be diluted with an equal volume of carbonic oxide. Peligot found in 99 volumes of the new gas, 28 carbonic oxide, 15 hydrogen, and 56 carburetted hydrogen (of all kinds). When from 1 lb. of oil 86 cubic feet of gas of 0.65 specific gravity are obtained, these must weigh 4.2 lbs.; 3.2 lbs. of carbonic oxide and hydrogen must, therefore, have been added to the constituents of the shale-oil by the decomposition of water, and yet these only make up 43 per cent. of the gaseous mixture, according to Peligot's analysis. Supposing even that a portion of the hydrogen serves to prevent the deposition of carbon, by becoming converted into carburetted hydrogen, yet so large a proportion of carbonic oxide, which is itself not luminous, can in no way be reconciled with the high illuminating power of the gas.

Mr. Sanders, of the Hibernian Gas-works, made extensive experiments, with a view to render water-gas luminous, as early as the year 1834, and enrolled a patent for his invention in 1835. His plan was to transmit steam through coke, peat or wood-charcoal, heated to redness in a succession of one, two, or three retorts, so as fully to reconvert the carbonic acid at first produced into carbonic oxide gas: a single retort, with a horizontal partition to within a few inches at one end, was sometimes used for the same purpose. The mixture of hydrogen and carbonic oxide was then passed through cream of lime to remove every trace of carbonic acid, and then into another retort or vessel, also heated to redness, into which were introduced tar, turpentine, resin, oil of resin, petroleum, asphaltum, bitumen (natural or artificial), naphtha, vegetable oils, animal oils, tallow, or caoutchouc, or the volatile oils produced by the destructive distillation of any of these substances. These substances were allowed to enter the retort in regulated quantities, according to the supply of water-gas, by which the more volatile portions were taken up and carried forward. As much naphthaline was thus volatilized, it was found necessary to pass the compound gas through condensers, in which it separated before the gas was allowed to enter the mains. The first idea in this process was to convert the substances containing excess of carbon, by means of steam, into olefiant gas, carbonic oxide, and hydrogen; this, however, failed in practice, the high temperature destroying the olefiant and heavy hydrocarbons, and the patentee was contented with impregnating the purified water-gas with very volatile hydrocarbons, although even this was eventually abandoned as an unremunerative source of illuminating gas.

Many other plans have since been patented to obtain these products. Manby invented a process, in which steam was passed through a retort set in a vertical position in a furnace, and heated to redness. The retort contained anthracite, stone-coal, coke-charcoal, or bituminous coal, together with a mixture consisting of one part of slaked lime, nine parts of silicious sand, and one part of clay. The admission of the steam could be regulated, and a small jet of gas was used in order to judge of the condition of the gas which was being generated.

Val Marino's patent has reference more particularly to the decomposition of tar by the agency of water-gas, although he does not confine his claim to that substance. Three retorts were employed, one for generating the water-gas, a second for fully decomposing any steam that might escape from the first, and a third in which the tar was decomposed by being heated in contact with an extensive surface of red-hot coke, and into which the gases from the second retort were conducted. Although an attempt was here made fully to decompose the steam before it entered the retort in which the tar was undergoing decomposition, it could not have been entirely successful, and later experimenters have found that steam in contact with iron or charcoal is never entirely converted into hydrogen and carbonic oxide; the oxide exerting a preservative action upon some portion of the aqueous vapor.

Radley likewise obtained a patent in 1845, in which, however, no new principle was introduced. White patented a process in 1847, in which all the prominent points of Sanders' and Val Marino's methods are retained; some slight modifications being made in the mode of decomposing the resin, fat, or tar, by a quantity of iron chain, arranged in the retort in a particular manner, which does not appear to be any improvement upon the coke employed by Val Marino for the same purpose. In 1849, another patent was taken by Mr. White for a different arrangement of the apparatus, particular stress being laid upon a horizontal partition, passing nearly to the back of the retorts, by which the water-gases were obliged to pass over a larger surface of the substances employed for generating the carbo-hydrogens—a plan already adopted by Sanders.

Two distinct decompositions of the water take place in all these processes, according to the temperature and other circumstances, the precise nature of which has not been traced. In the one, water is decomposed into equal volumes of hydrogen and carbonic oxide gases; in the other, into two volumes of hydrogen and one volume of carbonic acid. It is highly desirable to prevent the latter kind of decomposition as much as possible, so that very little carbonic acid shall be mixed with the gas, but in practice this has not been found possible when resin is used, as much as 16 per cent. of carbonic acid being often present in the mixture, which materially reduces its illuminating power. Dr. Fyfe considers the water-gas as a simple diluent of the resin-gas, and as such worthless, or rather a source of additional expense without compensating advantages, more gas being obtained, but of inferior illuminating value. Dr. Frankland, in experimenting upon White's hydrocarbon-gas from resin, found it to contain from 4.72 to 10.78 only of carbonic acid, derived chiefly from the water-gas, and this could only be separated completely by using caustic soda in connection with lime in the purifiers.

Dr. Frankland considers that the water-gas performs a most important part in preserving the heavy hydrocarbons from being decomposed, and in becoming itself saturated with the naphthas, which would otherwise be condensed, and which materially increase the illuminating power. The cost of the manufacture cannot be fairly arrived at from the experiments, as a fictitious value has been set upon the secondary product, or the resin-oil. The gas had, after complete separation of carbonic acid, the following average composition, its specific gravity being 0.5913:

Olefiant gas	8.13
Light carburetted hydrogen	29.71
Hydrogen	43.38
Carbonic oxide	18.78
	100.00

and the average quantity obtained from 1 cwt. of resin and 76 lbs. of water was 1,503 cubic feet.

Irrespective of the economic value of the process, the results of Dr. Frankland are not in accordance with the opinion of Dr. Fyfe, that the water-gas could only act as a diluent of the resin-gases. From Dr. Frankland's experiments, 1,500 cubic feet of gas, instead of 1,000, are obtained from 1 cwt. of resin, and these are of the average specific gravity and illuminating power of resin-gas itself, according to Dr. Fyfe.

In many of the works which were fitted up for making hydrocarbon-gas from resin, cannel-coal has now been substituted.

The retorts used in White's process are 6½ feet long, 25 inches high by 16 inches wide, and have an internal cubical area of 16 feet. The bed of two is capable of producing 10,000 cubic feet per day. Each retort has a horizontal shelf to within 12 inches of the back; a single door in front closes both partitions. The first retort is charged with coke or charcoal, which being brought to a strong red heat, water in a thin stream is introduced through a pipe and syphon. The water being at once converted into steam, this passes to the back of the upper partition, permeating the coke; and before it again arrives at the front of the lower chamber, is in great part converted into a mixture of hydrogen, carbonic oxide, and carbonic acid gases, which are then carried into the second retort, charged with cannel-coal. Steam, however, is still present in the mixture, and Dr. Frankland, in his report on the hydrocarbon-gas from cannel-coal, inclines to the opinion that it performs important service in the coal retort in decomposing *in some still obscure manner, the hydrocarbons which would otherwise be condensed;* carbonic oxide, a very large quantity of hydrogen, and a less highly carbonated carbo-hydrogen, being produced. The carbonic acid contained in the water-gas, which was not diminished in quantity by passing through resin, in the act of decomposition, and was very difficultly separated in the purifiers, is found to be almost completely removed, and probably converted into carbonic oxide in passing through a retort in which cannel-coal is being distilled, so that the resulting gas requires little or no purification; and yet, notwithstanding this reaction, the amount of carbonic oxide in the hydrocarbon-gas is not excessive. The quantity of carbonic acid produced by the combustion of the same bulk of gas obtained by the ordinary process, is greater than with the hydrocarbon-gas, although when such an amount of gas is consumed as is capable of producing an equal light from both kinds, the quantity of carbonic acid formed is somewhat greater in the latter.

The substances condensed by chlorine, bromine, and anhydrous sulphuric acid from illuminating gas, which are the same with each reagent, and to which the illuminating power of the gas is solely due, are found by Dr. Frankland to contain very different proportions of carbon, and to vary in proportion in illuminating power.

The condensable portion from different gases contained quantities of carbon vapor varying from 2.54 volumes to 4.36 volumes, indicating, in gases undergoing the same amount of condensation by chlorine, &c., a difference in illuminating power of more than 71 per cent. This has also been noticed by other experimenters. Dr. Fyfe observed very nearly the same illuminating power in gas from Boghead and Lesmahago cannel, although the condensation by chlorine in the one was 27, and in the other only 17.6 per cent. He conceived that the full value of the former, as an illuminating substance, could not be obtained in consequence of the imperfect methods at present adopted for burning rich gases; but Dr. Frankland finds that the 17.6 volumes of hydrocarbon, condensed from Lesmahago cannel-gas, contain as much carbon as the 27 volumes of hydrocarbon condensed from Boghead cannel, and the identity of illuminating power is thus satisfactorily explained. Mr. Leigh considers that the compounds $C_8 H_8$ and $C_6 H_6$ are among these condensed products, both of which must possess high illuminating power. Compounds also probably exist in coal-gas, which are not condensed by any of these agents, but which have great illuminating power, such as the hydride of amyl, $C_{10} H_{11} H$, and others of the series $C_n H_{n+2}$, of which light carburetted hydrogen $C_2 H_4$, or the hydride of methyl, is the first member.

The condensable hydrocarbons contained in ordinary coal-gas are frequently more highly illuminating than those contained in cannel-gas, as is shown by the following table, where the two are compared; and in the case of the latter the illuminating power is always directly proportional to the amount of olefiant gas to which the per centage of condensable hydrocarbons is equivalent. The establishment of this rule with regard to gases having such different per centage of light carburetted hydrogen as the Boghead gas with and without water-gas, Dr. Frankland holds to be conclusive evidence that light carburetted hydrogen has no higher illuminating power than hydrogen or carbonic oxide.

VALUE *of one cubic foot of the olefiant gas contained in the following gases, expressed in sperm candles, each burning* 10 *hours, at the rate of* 120 *grains per hour.*

CANNEL-GASES.

Ince Hall Cannel	2.95 candles.
Ditto, with water-gas	2.96 "
Boghead Cannel	2.80 "
Ditto, with water-gas	2.86 "
Lesmahago Cannel	2.58 "
Ditto, with water-gas	2.54 "
Ramsay's Newcastle Cannel	2.88 "
Ditto, with water-gas	2.86 "
Methyl Cannel	3.04 "
Ditto, with water-gas	3.03 "

COAL-GASES.

Pelton Coal	4.23 "
City of London Company's Gas	3.73 "
Gas of the Great Central Company (London)	3.91 "

The condensation test, which has often been taken as a measure of illuminating power, and considered to apply exclusively to the olefiant gas, cannot, therefore, be depended on. The photometer must always be employed, and the total quantity of oxygen required for combustion, or the quantity of carbonic acid produced by combustion before and after the removal of these heavy hydrocarbons by one of the above reagents, must always be ascertained in order to establish the real value of the gas as an illuminating agent.

Dr. Frankland ascertained that cold had little effect in reducing the illuminating power of the cannel-gases which were diluted with water-gas, but that the highly illuminating cannel-gases themselves suffered a considerable reduction.

The experiments were conducted on several kinds of cannel-coal, both with and without water-gas. The quantity operated upon was 1 cwt., and the heats employed in the retort were low, a certain per centage of the gas given off during the entire distillation being allowed to collect in a small gas-holder of 80 cubic feet capacity, for examination. A complete analysis of each gas, after passing through lime purifiers, was made in accordance with the foregoing remarks, and the illuminating power of the gases was also estimated by Bunsen's photometer as improved by Messrs. Church and Mann, and the value of the gas calculated in sperm candles burning 120 grains per hour during 10 hours.

The following table shows a summary of the experiments:

Name of Coal.	Cubic feet of gas per ton.		Illuminating power per ton in sperm candles.		Gain per ton by White's process.		Gain per cent by White's process.	
	By old process.	By White's process.	By old process.	By White's process.	Quantity of gas in cubic feet.	Illuminating power in sperm candles.	Quantity of gas.	Illuminating power.
Wigan Cannel (Ince Hall)	10,900	16,120	4,816	6,448	5,220	1,632	47.9	33.9
Ditto (Balcarres)	10,440	15,500	4,156	5,920	5,060	1,764	48.5	42.4
Boghead Cannel	13,240	36,160	11,940	21,368	24,920	10,038	173.2	83.4
Ditto (24 experiment)	.....	51,720	.....	20,668	38,480	9,378	290.6	82.4
Lesmahago Cannel	10,020	29,180	7,020	13,934	18,560	6,314	174.8	82.4
Methyl Cannel	9,500	26,400	5,916	11,088	16,840	5,772	175.2	103.6
Newcastle Cannel (Ramsay)	10,300	15,020	5,046	5,646	4,730	600	45.8	11.2

The following table shows the quantity of coal or cannel requisite for producing light equal to 1,000 sperm candles, each burning 10 hours, at the rate of 120 grains per hour:

Name of Coal.	Weight of Coal.	
	By old process.	By White's proc's.
Wigan Cannel (Ince Hall)	465.1	347.4
Ditto (Balcarres)	539.0	378.4
Boghead Cannel	197.5	104.8
Lesmahago Cannel	298.9	160.7
Methyl Cannel	421.4	292.0
Newcastle Cannel	443.9	396.7
Newcastle Coal (Pelton)	745.7	——

The general conclusions from these experiments are summed up by Dr. Frankland as follows:

1. White's process greatly increases the produce of gas from a given weight of coal or cannel, the increase being from 46 to 290 per cent., according to the nature of the material operated upon.

2. It greatly increases the total illuminating power afforded by a given weight of coal, the increase amounting to from 12 to 198 per cent., being greatest when coals affording highly illuminating gases are used.

3. It diminishes the quantity of tar formed, by converting a portion of it into gases possessing a considerable illuminating power.

4. It enables the illuminating power of highly carbonated cannel-gas to be profitably reduced, so as to be fitted for burning without smoke and loss of light.

5. No additional expense is incurred for the wear and tear of retorts, or in the purification of the gas.

(*To be continued.*)

SPRINGFIELD, ILL.—A correspondent in Boston asks for information about this institution. We are not posted up, nor do we know anybody from that locality except Mr. Lincoln, whose predilections, however, are not for matters pertaining to light.

BRIDGEPORT, CONN.—This is a very favorite gas company, well managed and popular. It declares regular eight per cent. dividends, and always has a stocking full of dimes laid by for rainy weather.

OXYGEN GAS IN FEVERS.

In our last issue we noticed the fact that Dr. Shumard, Medical Director of the Louisville district, had used oxygen gas in cases of typhoid and other fevers with much success. The following extract from the doctor's report will be found of much interest:

"November 29, 1862.—I have frequently had occasion, in the course of my medical practice, to observe the apparent great want of oxygen in the blood drawn from patients laboring under different forms of autumnal disease. Impressed with the belief that this deficiency was not merely apparent, but real, and that blood thus unfavorably constituted, if not the cause of disease, could not otherwise than exercise a very prejudicial influence upon the system, I several years ago instituted a series of careful comparisons between healthy blood and that drawn from patients laboring under different forms of autumnal disease, and succeeded in fully satisfying myself that such a deficiency really did exist, and that there was an excess of carbonic acid in the blood of all the cases examined. It, therefore, occured to me, that if oxygen gas could, by any means, be artificially supplied to the circulation it might afford a valuable remedy in the treatment of autumnal and various other forms of diseases. It also occurred to me that the best channel for administering the remedy would be that which nature has herself established for the reception of oxygen—the lungs. I therefore resolved to try the experiment as soon as a favorable opportunity presented itself.

"In 1857 I was called to see a case of severe congestive chill, in which the patient, a man about thirty years of age, was cold and nearly pulseless. Active stimulants and other remedies usually employed in such cases were freely resorted to. A small quantity of nitrous oxide gas was also prepared, and administered to the patient by inhalation. Shortly afterwards the pulse increased in volume, and in about one hour from the time of the inhalation the extremities became warm, and the patient recovered from his chill. As other remedies were here employed besides the gas, and may have exercised an important influence in relieving the patient, I concluded to await the result of other experiments before publishing the case.

"Shortly after this my duties called me to another portion of the United States, and I had no further opportunities for repeating the experiment until the twenty-second of the present month.

"Last summer while acting as Medical Director at Huntsville, Alabama, I repeatedly urged the employment of the gas in the treatment of disease. The different medical officers stationed at that post were favorably impressed with the idea that it might be made a useful remedy; but, from some cause or other, the gas was not administered. I also requested Dr. Newman, a highly accomplished private physician of Huntsville, to employ the remedy in such cases as he might deem favorable for its use. A number of physicians in Cincinnati were also urged, a year ago, to administer the gas in cases of disease.

"On the 22d instant a case of typhoid fever (Case No. 1), of a hopeless character, was reported from Danville General Hospital No. 3. As the patient was apparantly dying, and could not, therefore, be in any way injured by the experiment, I resolved to try the effects of the gas. Assistant-Surgeon Devindorf was accordingly directed to administer the gas to him immediately, which he did, in the presence of Assistant-Surgeons Samlere, Aichele and Simpson. The result was so striking in character as to impress every one present favorably with the remedy. I may here remark that two of the medical officers present, who were at first decidedly skeptical upon the subject, upon witnessing the results of the first experiment, immediately changed their opinions, and became enthusiastically in favor of the remedy.

"As soon as the favorable results of the gas began to exhibit themselves in case No. 1, Assistant-Surgeons Samlere, Aichele, Devindorf, Simpson and Avery were directed to visit the different hospitals in Danville, and, after having carefully examined the worst cases of diseases in each, to select such for experiment as were considered entirely hopeless. They accordingly reported to me cases Nos. 2, 3, 4, 5, 6, and 7, to all of which the gas was immediately administered. The reports of all these cases are now before you, and from them you will be able to judge whether the remedy is or is not worthy of more extensive trial.

"Without attempting an analysis of these cases I will merely remark that all the patients to whom the remedy was administered were pronounced hopeless by their attending physicians, and that their judgment in the matter was fully confirmed by that of the committee appointed to examine the cases before the gas was inhaled; that a striking improvement was observed in every case after the gas was administered; that under its influence warmth slowly returned to the extremities, after the most powerful diffusible stimulants that could be given had failed to produce that result; that the pulse increased in volume, and became much more natural to the touch; that the delirium which had, in several cases, existed for weeks previously, entirely subsided; that the involuntary discharges from the bowels, in all but one case, ceased; that several of the cases, after lying for many hours delirious, or insensible, became rational, and conversed with those around them; that the countenance assumed a much more natural expression; that the livid spots upon the chest and abdomen of two of the cases changed to a light rose color, and commenced disappearing; that the patients all expressed themselves as feeling much better; that the effects of the gas were not merely temporary but permanent; that in the four cases that have died, life was apparenty prolonged many hours by the remedy; and that three out of the seven supposed fatal cases are still living and may yet recover.

"I propose to continue the experiments, and shall hereafter not confine them alone to cases that are considered hopeless.

"Although it has thus far been tried in only eight cases, the results are sufficient to prove that we have in oxygen gas a remedy of surprising power, and one that bids fair to be of great service hereafter in the treatment of almost every variety of disease.

"The gas was administered to all the cases in the form of nitrous oxide, which was made in the usual manner, from nitrate of ammonia, by Professor Brikford, of Danville, and Assistant-Surgeon Samlere, United States volunteers. For want of better apparatus, it was administered to the patients from beef bladders, which answered the purpose moderately well.

"Although oxygen was employed in these cases in the form of nitrous oxide gas, I would not propose to use it so in all cases. In cholera and severe cases of congestive chill, I am persuaded that oxygen gas, in its pure form, or slightly diluted with atmospheric air, would be better; nor would I hesitate to give it in any form of disease in which the vital powers are depressed, since the cases recorded show that it relieves delirium and irritation instead of producing them."

Lighting Streets by Phosphorous.—I have alluded to the fact, that houses freshly painted with lime wash, are frequently luminous at night, though slightly, after exposure to the sun's rays during the day. If, by chemical and physical research, a means were discovered capable of rendering this phosphoric light more powerful, by employing sulphides of calcium, or barium, &c., and superadding, if necessary, the action of an electric current when the sun is hidden by clouds, a street might be effectively illuminated by phosphorescent light alone.—*Phipson on Phosphorescence.*

Sewerage of Paris.—The system of sewerage of Paris has hitherto differed essentially from that of London, in still retaining for the most part, cesspools beneath the court-yards of the houses; the most copious use of water has, however, necessitated a change; and the municipality is proceeding to provide for the new order of things by the construction of sewers beneath the street, and combining with them collecting reservoirs and a general distribution of water, comprising an ingenious self-acting method of cleansing the sewers, whilst introducing a more comprehensive and general system of carring off the water. This combination is well exhibited by a plan of the sewers of Paris, and a model in section of the sewer of the Boulevard Sebastapol, with a plan of the water service of Paris, and a model in section of the reservoir at Passy, in the Great Exhibition.—*London Builder.*

THE ELECTRIC LIGHT IN LIGHTHOUSES.

In one of his reports on the Dungeness light, written during the year 1862, Professor Faraday mentions an interesting experiment. Arrangements were made on shore (Mr. Holmes being in charge of the light), by which observations could be taken at sea about five miles off, on the relative light of the electric lamp and the metallic reflectors with their Argand oil lamps. At the given distance the eye could not separate the two lights, but by the telescope they were distinguishable. The combined effect was a glorious light up to the five miles. Then, if the electric light was extinguished, there was a great falling-off in the effect; though after a few moments' rest to the eye it was seen that the oil lamp and reflectors were in their proper state. On the other hand, when the electric light was restored, the illumination became again perfect. Then, while both were in action, the reflectors were shaded and the electric light left alone; but the naked eye could see no sensible diminution; nor when the reflectors were returned into effectual use could it see any sensible addition to the whole light power; though the telescope showed that the alteration in the lantern had taken place at the right time. Such was the power of the electric light that the addition or subtraction of the light of a fully effective set of reflectors, with their lamps, would not have been sensible to a mariner, however observant he might have been. Professor Faraday enumerates some points which are against and others in favor of the light. In the first place, the simplicity of the present systen is very great compared with that of the electric light; only two keepers are required to a lighthouse; they need possess no special knowledge; ordinary attention is all that is necessary, and thus failures of the light are almost impossible. In the new system a second set of men will be required to attend the the engines, and there must be amongst them one or more who understand the principle and construction of the lamp in the lantern, of the magneto-electric machines, the steam-engines and the condensers, and be able to make effectively the repairs necessary to the apparatus. In the next place, the expense of the new system must be large compared with that of the present system. Other objections have been made, of which Professor Faraday cannot see the force, namely, that the light is too bright, that it gives a false impression of the distance of the lighthouse, and that it blinds the eyes of the mariners to the perception of the lights on board of a vessel between it and them. These objections, he says, if they have any force, must be judged by mariners themselves. The points in favor of the magneto electric light are strong and clear in relation to the increase of light. In cases where the light is from lamp-flames fed by oil, no increase of light at or near the focus or foci of the apparatus is possible beyond a certain degree, because of the size of the flames; but in the electric lamp any amount of light may be accumulated at the focus and sent abroad, at, of course, an increased expense. In consequence of the evolution of the light in so limited a focal space, it may be directed seaward, diverging either more or less, or in a vertical or horizontal direction, at pleasure, with the utmost facility. The enormous shadow under the light produced by the oil-flame burner, which absorbs and renders useless the descending rays to a very large extent, does not occur in the magneto-electric lamp; all the light proceeding in that direction is turned to account; and the optical part of the arrangement, whether dioptric or reflecting, might be very small in comparison with those in ordinary use.—*London Athenæum.*

Aurora, Ind.—The water-gas works at this place, so often the subject of correspondence in this Journal, have turned out to be an *ignis fatuus.*

The community have been bored to death with the attempts at illumination which they declare to be a cross between the Aurora Bore-alis and outer darkness. How far a pun is incorporated in this comparison we really cannot say, but we do know that Dr. Sanders has been dismissed, and the patient has been placed under the care of Dr. John Jeffrey, of Cincinnati, O., who at once recommended a coal diet to restore a proper circulation of gas to the expiring subject. Dr. Jeffrey is well-known as a successful physician in reviving still-born gas prodigies, so that the most beneficial results are anticipated in this case.

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THE
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PUBLISHED ON 1ST AND 15TH OF EVERY MONTH.

C. ELTON BUCK, ... EDITOR.

THURSDAY, JANUARY 15, 1863.

The various attempts to utilize the gases resulting from the decomposition of water, in the manufacture of illuminating gas, show a spirit of resolution and perseverance in the patentees of these processes, which seems worthy of a better remuneration than they have generally received. Water-gas has held out allurements to some engineers, which they have found difficult to resist; and a strong faith in the ultimate triumph of the innovation, has been manifested by a few, notwithstanding disappointments enough to bring dismay to the most sanguine disposition. In another column the brief story of the Sanders water-gas at Aurora, Ind., is told. This process, which has been mentioned repeatedly in our columns, and for the rights to use which, large sums of money have been paid, has had an existence of a few brief years—years which have abounded in promises, if they have not been productive of facts. In various parts of the country, new works have been built to use the Sanders process; but we cannot mention more than half a dozen now—if even that many can be named—where it is in operation. At Aurora, the works were erected by Mr. SEVERIN, who, previously, had very little acquaintance with gas matters. This gentleman, having formed a very favorable opinion of the process, purchased the right for his town, and for a long time after the completion of his works, the place was lighted with water-gas alone. On page 269 of our second volume, and again on page 25 of our third volume, will be found letters from Mr. SEVERIN, in which he speaks of the process in the most favorable terms. In the former letter he gives a description of the works, with the length of mains, amount of nightly consumption, &c., and mentions the quantity of rosin he then used to carbonize one thousand feet of the gas. In the second letter, he announces that he has made improvements by using "refuse coal-oil," by which the cost of making the gas was reduced. Still his opinions were favorable, and he was "yet making water-gas successfully." A change, however, seems to have "come o'er the spirit of his dream," for the Aurora water-gas works are being altered into coal-gas works, and Mr. SEVERIN is still their owner. He has surely given the Sanders process a long and faithful trial, but, judging from his actions, he must have discovered the superior advantages of coal-gas.

This *denouement* of gas-making in Aurora will go far to sustain the opinions expressed by J. C. CRESSON, Esq., engineer of the Philadelphia Gas Company, at the time of his experiments with the Sanders process. These experiments, which were tried on a working scale, were not considered at all favorable to the new process; and because Mr. CRESSON would not commend it, when he could not truthfully say one word in its favor, he was bitterly assailed by the representatives of the Sanders patent in Philadelphia, and all manner of obloquy was heaped upon him. Time, and the experience of other parties, have sustained the views of Mr. CRESSON, and we have yet to see the revolution which was to be caused by the process which has just been forsaken by one of its first advocates. Inquiries are often made about the "Keystone Water-Gas Company" and its New York prototype the "Hydrogenated Fuel Company." The latter corporation could not have a better opportunity than the present for showing its value, if it have any. A chemist who is somewhat known to fame as an agriculturist, but utterly without experience in gas matters, expressed the opinion that hydrogen gas could be made for heating purposes for *five cents* per thousand cubic feet; and it was ostensibly for heating that permission was granted the company to lay pipes through the city. With coal at eight dollars a ton, this winter would be a golden opportunity for making money, and for this hydra-headed company to prove the value of its promises. Why has it been allowed to repose for so long a time? Patents are granted for only a few years, and yet several winters have been allowed to slip by without any effort to verify the assertions of the advocates of this calorific concern. As the "Hydrogenated Fuel Company" is of the same genus as the Sanders water-gas, it is natural when inquiries are made about one, that the other should be remembered. Will they hereafter be remembered only among things that were?—or will it still be proved that the process is really valuable, and a desideratum to the gas engineer?

For the benefit of those of our readers who desire to know something of the past history of water-gas, we reprint from Ronalds and Richardson's Technology, part of a chapter on this subject. It will be seen that water-gas is no new thing.

Our correspondent 'Querist," in his letter in another column, suggets that the letter of "An Advocate of Coal-Gas" in our last number, did injustice to the writer describing the petroleum and water-gas process used at Homer, by ridiculing his description of the theory of the decomposition of the water and the reduction of the hydrocarbon vapors of petroleum. Our correspondent refers to Dr. FRANKLAND'S opinion that steam acts in "some still obscure manner" in such cases. We will not attempt to answer "Querist's" letter now, except to say that the two cases are not parallel in any way. In the one referred to by Dr. FRANKLAND, cannel coal was used to carbonize the water-gas; while in the process described by the writer in the *Journal of the Board of Arts*, petroleum was the carbonizing material. The two processes are also totally different as to the arrangement of the apparatus, although they are both water-gas processes. There are other chemists quite as eminent as Dr. FRANKLAND, who deny that hydrogen and carbonic oxide have any other effect than to dilute the rich gases generated by the carbonizing material. Dr. FYFE'S opinions, as will be seen by a perusal of the chapter in another column, were quite at variance with those of Dr. FRANKLAND, and he could not discover any benefits resulting from the use of water, but reported adversely to the whole process.

In London, England, the Court of Sewers have adopted a resolution to attach a meter to each of the lamps in the Great Central Gas Company's district, where carburators are now used. These lamps are 1,771 in number. It is not often that we find any opinions in the *Journal of Gas-Lighting* worthy of hearty commendation, but the following remarks on this subject strike us as being eminently sensible:

"This is an important event in the history of gas-lighting, and marks the commencement of a new, and, we trust, greatly improved system in the supply of gas to street lamps. We will not inquire too curiously into the circumstances and motives that have induced the commissioners to adopt that resolution; but, by whatever influence produced, we hail, with satisfaction, the introduction of a plan which we have long advocated as the only proper mode of settling disputes when discontent exists concerning the supply of gas. The rude and unsatisfactory method of contracting for a supply, on the basis of a calculated yearly consumption, has long since been abandoned in private lighting, and it is extraordinary that it should have been retained so long in the supply of public lamps, notwithstanding the frequent dissensions to which such a system gives rise. The first cost of a meter, or the rent of one, is not worth consideration, when compared with the saving of the many bickerings and disputes between the local authorities and gas companies about alleged deficiency of supply. The civic authorities of London, when abandoning the old contract system, and taking the entire control of the street lamps on themselves, have an excellent opportunity, of which, it is to be hoped, they will take advantage, of rivalling the cities on the continent in their arrangements, and of putting an end to the reproaches that have been levelled against them, for their want of taste in all that relates to public lighting."

We heartily approve every word of the above, and are disposed to award to "*Pater familias*" due honor for advocating so sensible a reform It is incomprehensible how the contract system, with its countless wrongs, has been put up with for so long a time. It is contrary to every principle of right and justice: it gives rise to endless disputes, and we have yet to hear the first sound argument in its favor. In this city, where the public lights are a standing disgrace to the authorities, the adoption of meters on the lamps would soon lead to a better state of affairs. Under the present contract system we can never hope for a radical change. It is true, larger burners might be adopted under the present arrangement, and thus a better light be secured. The street lamps are now supplied with 3-feet burners; but we venture to say that much less than 3 feet of gas per hour is consumed in them. We have seen many lamps, and these too not in some obscure streets, but in Broadway and Fifth avenue, where the flame of an ordinary candle would have emitted more light. We do not make these remarks in disparagement of the city gas companies. Such a state of affairs is rather detrimental to their interests, and we are sure they would rejoice in the adoption of a radical reform. Strangers coming to the city, entertain an erroneous idea that because of the miserable dimness of the street lamps, the gas made by the city companies must be of a very inferior quality. They seldom think that the size of the burner accounts for the insufficiency of light. We hope that this whole subject of public lighting will soon receive a thorough overhauling, and that a new system will be inaugurated, whereby improved burners may be used and the gas properly measured and sold to the city as it is to ordinary customers.

GAS-LIGHT STOCKS AS AN INVESTMENT.—Public attention is now very generally directed to gas-light stocks as a permanent investment. Doing a strictly cash business, at a certain and liberal profit, its risks small and divided, with daily increasing facilities for the more economical manufacture of gas and a steady progressive increase of consumption, gas-light stocks are becoming one of the most favorite, as they are the most certain of all species of investment.

MANHATTAN, N. Y.—Offers are made for this stock at two hundred per cent., and no sellers at that price. The company say this is more than it is worth. Buyers don't seem to think so, nor do the stockholders, else they would sell.

METROPOLITAN, N. Y.—It is expected that gas will be issued by this company on 1st June next, when the price of stock will rise to probably one hundred and fifty per cent.

ANSWERS TO CORRESPONDENTS.

J. E. F., of N. Y.—*We cannot see the force of your reasoning. Your objections may be well founded, but you should prove them beyond all doubt, ere taking the step you are contemplating. The old proverb, "Look before you leap," may apply in your case as well as in that of others.*

G. F. B., of Vt.—*We agree with our correspondent entirely. It is a water-gas process, as any person of sufficient knowledge of this subject, and unbiased judgment, must see at a glance.*

A. Z., of Pa.—*We intend to discuss the subject in a future number, but are not yet prepared to venture an opinion. It is a question which ought to receive much study and attention.*

E. W. S., of Ind.—*Your informant was correct, as you will perceive by an item referring to the change, in another column. The water-gas had to succumb entirely to coal-gas.*

J. S. P., of Cal.—*We have handed your letter to the proper party, who will write to you. It is a matter in which we would not interfere, having made an inflexible rule to that effect.*

O. E. J., of N. Y.—*We do not know. Very much depends upon circumstances. They may get into operation in the early spring, but this is very uncertain.*

CORRESPONDENCE.

PETROLEUM AND WATER-GAS.

NEW YORK, January 9, 1863.

To the Editor of the AMERICAN GAS-LIGHT JOURNAL:

Your correspondent writing over the signature "An Advocate of Coal-Gas," in his strictures upon the theory of water-gas process in operation at Homer, N Y., ridicules the description given of the "reducing power" of steam of a high temperature, which the writer of the article in the *Journal of the Board of Arts* mentions in the most gingerly manner. While the description of this part of the process was extremely unsatisfactory to me, yet, on a calm reflection on the subject, I cannot see how a better one can be given. It may not be generally known, but it is nevertheless a fact, that water and petroleum, run together into a red-hot retort in streams of proper size, are immediately converted into gas of high illuminating power, and what is very remarkable, thorough condensation will cause the deposition of a *very* small quantity of the water, showing that the greater part of it must have been converted into permanent gas. Now, this sets all previous theories at defiance, and gives some plausibility to the statements made in the Canadian journal relative to the operation of the process referred to. A very eminent English chemist, who has had much experience in gas matters, including water-gas—I refer to Dr. Frankland—in his report on hydrocarbon gas from cannel coal (which in this instance was used as the carbonizing material), is of the opinion that steam in the retort performs important service in the coal retort, in decomposing, in "*some still obscure manner*," the hydrocarbons which would otherwise be condensed; carbonic oxide, a very large quantity of hydrogen, and a less highly carbonated carbo-hydrogen being produced.

Now, if steam has this "reducing power" which it exerts in "some still obscure manner," why may not the explanation of the process so severly criticised be, after all, the correct one? for it seems to me that Dr. Frankland's explanation, or rather "lack of explanation," is as much open to criticism as the article so mercilessly handled by your correspondent.

There is a great deal of interest manifested by country engineers in the subject of petroleum-gas and water-gas, and as they have had very little information about it, a few words in reference to the subject may not be out of place. QUERIST.

BULL ON FINANCES.—In a late number of the London *Gas Journal* the astute editor said, "According to the "best advices, gold (in America) was at a premium of "from 18 to 20 per cent., or, in other words, 118 or 120 "dollars in paper must be paid for 100 dollars worth of "coal. Labor would rise in a still greater proportion, "owing to the drain to supply the army, *and the profits* "*of the American gas companies must disappear unless* "*they advance their prices with the rise of all other arti-*"*cles.*"

Not one of the American gas companies has raised the price of gas; on the contrary, several have reduced it since the war broke out, and yet the stock of many has increased—*that of the New York companies over twenty-five per cent.* Bull is a great prophet.

WOODEN SIEVES FOR GAS PURIFIERS.

The following letter, concerning the conflicting claims of the patentees of wooden sieves for gas purifiers, has been handed us for publication.

NEW YORK, Jan. 6th, 1863.

Mr. N. O. HAWXHURST:

Sir,—In answer to the enquiry about the patent to R. G. Hunt for improvement in sieves for gas purifiers, I have to inform you that the only thing for which said patent was granted is simply making the bar wider at the end of the slots.

The wording of this claim might deceive persons unacquainted with law into supposing that he had a claim to the solid conically slotted sieve, but it is only for the conically slotted sieves when formed at the ends, so as to leave a wider bar at that point. A patent for the conically slotted sieves was refused to Mr. Hunt—first, by the Examiners; and secondly, on appeal, by the Board of Examiners in chief; thirdly, by the Commissioner of Patents; and lastly, by the Judge of the Circuit Court of the District of Columbia, whose decision is by law made final. The invention of the solid conically slotted sieves was, by the same final authority, decided to be the invention of Wm. Combe, and a patent therefor was issued to you as his assignee; and should Hunt, or his assignees, or any other person, attempt to make the sieves or use the same without your license, they would infringe upon your rights, as secured to you by said patent. It may be proper further to add, whatever of invention has been secured by patent, in the name of R. G. Hunt, belongs to his assignees, John L. Cheesman and R. R. Hunt, to whom he assigned the invention before the patent was granted.

J. J. GREENOUGH,
Counsellor-at-Law,
No. 6 Wall St.

ARTIFICIAL LIGHT—VENTILATION.

In the numerous improvements which have taken place in gas-lighting—in the adoption of burners and new designs for fixtures—too little attention has been paid to the very important subject of ventilation. All artificial illuminating agents, undergoing combustion, produce large quantities of carbonic acid, with traces of other deleterious substances. Although coal-gas generates far less of these noxious substances, in proportion to the amount of light given, than any other illuminating agents—as is attested by the experiments of Lewis Thompson, Esq. and Drs. Leeson and Warrington, of London—yet ventilating gas burners are far too seldom used, and in a large majority of apartments the foul air caused by combustion has to find its way out through chinks and crevices as it best can.

Our neighbor of the *Scientific American* has a timely article on this subject, mainly addressed to architects, urging the great importance of a thorough ventilation, whereby the results of combustion of illuminating agents may be carried off. The following remarks will be subscribed to by many of our readers:

All buildings should be designed and erected with regard to the health and comfort of those who may occupy them temporarily or permanently, and provision should certainly be made in them for the removal of the foul gases arising from gas and other lights. Every person knows that the burning of an open charcoal fire in a room is dangerous to life, because the product of combustion is carbonic acid gas, which is as injurious to the human system, when inhaled by the lungs, as the taking of arsenic into the stomach. Now, as ten gas-jets are equal to a moderately-sized fire in a stove for producing carbonic acid, it is not difficult to estimate the injurious effects of burning open gas-jets in apartments. We regret that the suggestions referred to have as yet been acted upon in a very few cases, but the good work is begun, and all honor to the architects who have been the pioneers of the improvement.

Not only churches and other public buildings in which gas is burned should be arranged with provision for the removal of the subtle poison arising from burning gas, but dwelling-houses also. Indeed, such appliances are more necessary for them than public buildings, such as churches, court-rooms, &c., because persons in the former are constantly exposed to carbonic gas during evening hours, whereas in public buildings the exposure is only temporary. The application of such improvements is just as necessary in places where oil is consumed in lamps, as in those where gas is burned.

Well spoken and to the point. But others than architects may devise means to remedy the evil. Mr. J. O. N. Rutter, well-known as a writer upon gas-lighting, invented, a number of years ago, a ventilating gas-burner, in which none of the products of combustion escaped into the room, but were conveyed away as fast as generated. We wonder that this simple and admirable arrangement has not been more generally adopted here, as well as in England, whence the invention emanated. Other ventilating burners have also been made, but very few of them seem to be used, and it is but reasonable to infer that this limited employment of such appliances to health, is on account of the general indifference of the people to such matters. The homely proverb, "An ounce of prevention is worth a pound of cure," is frequently ignored, and it is only when the "cure" is needed that the folly of such indifference is made manifest.

CARBURATION OF GAS IN LONDON.

In our last number we published the report of Mr. Hayward and Dr. Letheby on the carburation of gas in London. A recent number of the *Journal of Gas-Lighting* has the following comments on their report:

The report of Mr. Hayward and Dr. Letheby on the consumption of gas in the public lamps in the city, and on the carburating process, published in our last number, formed the alleged ground on which the commissioners founded their resolution to adopt the system of supply by meters. We are not disposed to be severely critical with a report which has produced such a result, though the data on which Mr. Haywood and Dr. Letheby have based their conclusions were so imperfect that those gentlemen seem scarcely to have anticipated that the Court would have acted upon them. They admit, indeed, that "a far more varied and extensive series of observations, spread over a greater length of time, will be necessary before such observations as these can alone be made the basis of final and positive conclusions." If the registration by the experimental meters is to be taken as representing the average supply of gas to the burners, it appears from the report that after the first three nights all those lamps with 3-feet burners were supplied with more than the stipulated quantity. So far at least as regards the metered lamps, the carburetting process had, therefore, an unfair advantage compared with the common gas supplied to the 5-feet burners, the average quantity of which is stated not to have exceeded 4.69 feet. When, however, the comparative powers of the two lights were tested by the "rough observations" taken to ascertain the distance at which a given object was visible, the difference of distance in favor of the carburetted light was not proportionate to the difference of excess in one case and of default in the other of the registered quantities of gas consumed. The experiments with the carburators were, indeed, very incomplete and unsatisfactory. It is stated, for example, that, according to the same rough method of observation of the lamps fitted with carburators, those with meters gave 58 per cent. more light than those without meters, and of the lamps without carburators, those with meters gave 55 per cent. more light than those without. The object of these experiments was to show that the gas companies must have directed the lamp-lighters to turn on a larger supply to the burners of the lamps fitted with the meters; and, if such rough observations could be depended on, they would show also the utter fallacy of attempts to ascertain the consumption of street lamps by taking the average of one in twelve, whether the lamps be lighted by the gas company, or by the local authority. But, as regards common gas, with the 5-feet burners, if there were any intention on the part of the gas company to "doctor" the burners of the metered lamps, they could surely have managed better than to supply them with less than the quantity contracted for; and as regards the carburetted gas, there was no evidence to show what was the quality of the naphtha in the carburators of the lamps compared, on which the illuminating power of the light materially depends. One might have been filled with naphtha which gave off inflammable vapor at 60° temperature, while that in the lamp without meter might have required 104° for its vaporization; and Dr. Letheby reports that he found a difference to that extent in the qualities of the naphtha in the 15 carburators he examined.

It is well known that little reliance can be placed on rough observations of any kind, especially on rough

photometrical observations, when the test is "ascertaining the distance at which a given object is visible." The reports of Mr. Haywood and Dr. Lethaby, indeed, contradict each other in so many instances, as to become of little value in establishing any charge against the gas companies. Thus, Mr. Haywood asserts boldly that "the lamps with carburators and with meters, consuming nominally 3 cubic feet of gas per hour, give superior light to lamps without meters burning nominally 5 cubic feet per hour." Dr. Letheby, on the other hand, found, by careful examination in his laboratory, that the maximum increase of the illuminating power from the naphtha in the 15 carburators he examined, was only 24 per cent., and that it was as low in some of them as 6.3 per cent. We are surprised that these experiments did not open Dr. Letheby's eyes to the true nature of the carburetting process, and the conditions on which the increased illuminating power depends. The 15 specimens of naphtha were probably originally all of the same quality, and emitted inflammable vapor at a temperature of less than 60°; but as the more volatile portions became absorbed by the gas, the residue increased in density, until in some instances, no inflammable vapor was given off at a less temperature than 104°; and, where the carburator containing such residue remained below that degree of heat, it might almost as well have been filled with water, so far as any luminous property could be imparted to the gas in contact with it. Had the Carburating Company understood their true interest, they would have emptied the exhausted residue from the boxes, and refilled them entirely with fresh naphtha, instead of adding to the fluid that had been deprived of its volatile property. In the face, however, of these experiments, Dr. Letheby asserts that "a gallon of the naphtha of the proper strength will continuously supply about 6.5 grains of hydrocarbon to each cubic foot of 9,000 cubic feet of gas. Properly distributed, therefore, 1½ or 2 gallons of good naphtha would be sufficient for a year's consumption of gas at each lamp." In this calculation, he reckons on the naphtha retaining the same degree of volatility to the last drop; but it would be found in practice, that the "good naphtha" capable of giving 6.5 grains of volatile vapor to each cubic foot of gas, would gradually become deteriorated; and that, as in the case of some of the specimens examined from the carburators, it would fail to give additional luminosity to the gas. We believe that experiments have been made to ascertain the effect of the heat from the burners in raising the temperature of the naphtha in the carburators fixed to the lamps in the city, and that the results proved that it does not much exceed 20°; so that when the temperature of the atmosphere is 60°, and the naphtha requires 90° to become volatilized, the carburators are ineffective. The influence of temperature on the carburetting process seems to have been overlooked by its advocates, though it strikes at the root of the system. Even the most volatile naphtha that gives off inflammable vapor at 70°, will have little or no effect in the carburators when the external temperature is reduced below 40°; while, in summer time, it will be wastefully evaporative. The irregularities in the degree of luminosity imparted to the gas by the naphtha vapor would greatly exceed those complained of as resulting from variations of pressure.

Coal-Gas and Oxygen Street Lamps.—A London exchange says, that a street lamp supplied with coal-gas and oxygen, manufactured according to Mr. Webster's patent, has been exhibited several evenings in Parliament street in that city, and with great success as far as regards the brilliancy and steadiness of the light. On the most favorable view of the Webster process for making oxygen, the increased illuminating power of this light is obtained at an expense of 6 per cent. greater than common gas.

Iron-lined Barrels for Kerosene Oil.—A lot of kerosene oil, in iron barrels encased with wood, was stored in a building lately burned in Boston. Some of the oil was saved. The wood was completely burned, leaving the iron lining and the oil highly heated, but not ignited. This test is important to insurance companies and oil dealers, showing there is but little risk from fire when the oil is properly refined and placed in suitable barrels.

ANOTHER COLLIERY EXPLOSION IN ENGLAND.

On December 8th, another colliery disaster occured in England. Fifty-four miners were killed by an explosion of fire-damp in the Edmunds Main Colliery, Worsbro' Dale, near Barnsley. The mine is the property of Messrs. Bartholomew, Tyas, Mitchell & Co., who also own the Wombwell Main in the same valley, which has been on fire for the last nine months. There are two downcast shafts, close together at the Edmunds Main Colliery, and an upcast or cupola shaft for ventilation about two hundred yards off. The workings extend for nearly a mile and a quarter eastward from the shafts, and a little beyond them a new pit called the "Swathe" is being opened.

It was at the part of the Edmunds Main nearest to the Swathe, and where the men were at work to form a junction between the two pits, that the explosion occurred. This was the deepest part of the pit, being about one hundred and eighty yards from the surface, and was technically known as the dip boards. Here a charge of powder was fired between half-past seven and eight o'clock on Monday morning, to dislodge the coal. About half a dozen men were engaged at this spot, and the shot was fired by Joseph Walton. The effect of the shot was to ignite a quantity of gas which was dislodged by the explosion, to set fire to the seam of coal, and to destroy a portion of the brattices which regulate the current of air through the mine.

Those nearest to the dip were warned by the sight of the coal on fire to hurry to the shaft. Five got to the shaft, and declared that they were the only ones from that locality who escaped. One of them, who had nine hundred yards to run, felt the approach of the insidious choke damp, and stuffed his cap into his mouth to prevent suffocation by the gas. As he ran he stumbled over a score of bodies of dead and dying men whom the gas had already reached. The main body of the miners, to whom no merciful message telling that imminent danger existed had been sent, first knew their danger by the oncoming of the stealthy choke-damp. All who could hastened to the shaft and were raised to the surface as rapidly as possible.

It is said that among the first to ascend was as old man, a Wesleyan, who, before he left home in the morning had told his sons that he felt a presentiment of an approaching calamity. After engaging in family worship he said, "Lads, I don't feel easy yet; let's ask the Lord again to protect us." They bent their knees in prayer again and then proceeded to their work. They had not been in the mine very long when one of the sons ran to the old man, who worked near the shaft, and said, "Father, there's a wall of smoke coming up the pit." The experienced miner knew the sign, and leaving all their clothes except the trousers in which they worked, the father and his sons got on the corve of coals about to ascend the shaft, and were the first to give the information of the explosion. Many times the cages were lowered and raised with their living freight, to the intense joy of the women, whom the speedy rumor of the explosion brought to the spot, and who recognised their husbands and sons in the saved.

Shortly before four o'clock the last attempt was made to explore the mine. The party descended to within ten yards of the bottom of the shaft, when they found so much heat and so great a quantity of choke-damp that they were compelled to give the signal to be raised. The unsuccessful result of this experiment established the fact that all the men remaining in the pit were dead, as suffocation speedily ensues where the choke-damp penetrates.

Coal Beds of Michigan.—Professor Winchell, State Geologist of Michigan, reports that the whole central area of that State, embracing one hundred and eighty-seven townships, or six thousand seven hundred square miles, is underlaid by coal seams, ranging in thickness from three to five feet. Mines have been opened in several places, three at Jackson and one at Corrunna, which last year yielded over twenty-five thousand tons. The coal resembles that of the Illinois beds in quality.

Williamsburg, N. Y.—This company has called for another instalment upon its increased capital. It is surmised that it is to guard against the extension of the Citizens' gas-pipes in that direction. The stock is at about 120 per cent.

The New Croton Reservoir.—Mayor Opdyke in his message to the City Councils, makes the following remarks in reference to the Croton Aqueduct, and the new reservoir in the Central Park:

The crowning feature of the Croton Aqueduct, the large reservoir in the Central Park, was completed and the water let in on the 19th day of August last, and it is now filled to about two-thirds of its capacity. Its completion adds greatly to the value of that beneficent work, and furnishes a new safeguard against conflagrations and a deficient supply of water. Its immense capacity will be best illustrated by a comparison with the old reservoir.

Old Receiving Reservoir.	New Reservoir.
Area in embanked walls, 37 5-100 acres,	106 75-100 acres
Area of water surface...31 do.	96 do.
Capacity when full, 150,000,000 gals.	1,029,880,145 gals.

Elevation of water surface above sea level 114 10-100 feet.

These figures show that the new reservoir has about seven times the capacity of the old one.

This magnificent fountain of health has as yet received no appropriate name by which it may hereafter be designated. The Croton Board at an early day recommended the adoption of "the Lake of Manahata," and more recently the New York Historical Society suggested the name of "Lake Manhattan." While either of these names would be appropriate, I should prefer the adoption of the former, because I hope the latter will yet be used to designate this imperial city under boundaries so enlarged as to embrace Brooklyn and our other suburban population.

The following statement furnished me by the Croton Aqueduct Board shows a satisfactory increase of the revenue of that department.

The receipts for water rents and penalties for the year 1862, were.....	$783,234 60
Do. for 1861.....	765,954 35
Increase.....	$17,280 25
Receipts in the largest previous year ('60)	$767,169 62
" in 1862	783,234 60
Excess in 1862 over 1860.....	$16,064 98

Gas in England.—According to the report of Dr. Hillier, the examiner of the gas supplied by the Imperial Gas Company in St. Pancras, London, the quality of the gas distributed during the month of October last, was nothing to brag of. The illuminating power of this gas ranged from 12 to 14 candles, averaging 13.1 candles. A considerable quantity of ammonia was reported, and as much as 12 grains of sulphur in 100 cubic feet of the gas. If the engineer of the Imperial Company cannot make better gas than this, he had better give place to some one who can. With 12 grains of sulphur in 100 cubic feet, plenty of ammonia, and only 13.1 candle power gas, the consumers of St. Pancras have just grounds of complaint.

Dr. J. Northcote Vinen reports for the two weeks ending Nov. 22 and 29, a rather better state of affairs in the district supplied by the Surrey Consumers' Company, as follows: ammonia, slight trace on three occasions; no sulphuretted hydrogen; illuminating power averaged 13.50 and 13.36 candles.

The Bath Gas Company have reduced the price of their gas from 4s.6d. to 4s.2d. per thousand cubic feet.

Gas-works are about being erected at Burnham. The "Burnham Gas Company, Limited" has been established, and the works will be built by Mr. Jabez Church, civil engineer, Chelmsford.

Memphis, Tenn.—There is some stock of this company in town for sale. The unsettled state of that country renders it rather a ticklish investment to trust at present.

Gas-fitters at the War.—It is estimated that there are over five thousand plumbers and gas-fitters in the army at this time. Quite a respectable body of readers for this Journal, of themselves.

Painsville, Ohio.—This company was chartered in 1861, and commenced furnishing gas November 1st of that year. The capital of the company is $40,000; par value of shares $25. Population of gas district is 2,500. Price of gas $3.50 per thousand cubic feet.

COAL PRODUCT OF THE UNITED STATES FOR 1860.—Statistics of Coal produced in the United States during the year ending June 1, 1860, copied from the preliminary report on the eighth census:

	Bituminous.		Anthracite.	
States.	*Bushels.*	*Value.*	*Tons.*	*Value.*
Rhode Island....	95,000	$28,500	1,000	$5,000
Pennsylvania....	66,994,295	2,833,859	*9,397,332	11,869,574
Maryland	14,200,000	464,388	.....	.....
Ohio	28,339,900	1,539,713	.....	.....
Indiana	379,035	27,000	.....	.....
Illinois.....	14,258,120	964,187	.....	.....
Iowa.....	72,500	6,500	.....	.....
Missouri.....	97,000	8,200	.....	.....
Kentucky	6,732,000	476,800	.....	.....
Virginia.....	9,542,627	690,188	.....	.....
Georgia	48,000	4,800	.....	.....
Alabama	10,000	1,200	.....	.....
Tennessee	3,474,100	413,662	.....	.....
Washington Ter'y	134,350	32,244	.....	.....
	144,376,927	7,491,191	9,398,332	$11,874,574

Anthracite—tons.....	9,398,332	$11,874,574
Bituminous—tons.....	5,775,077	7,491,191
Aggregate tons.....	15,173,409	$19,365,765
Value of coal mined in 1850.....		7,173,750
Increase, (169.9 per cent.).....		$12,192,015

* Of bituminous coal, Pennsylvania produced 46.4 per cent. of the quantity and 37.8 per cent. of the value of the whole; of all kinds of coal, 75.9 per cent. of the whole value.

U. S. Railroad and Mining Register.

WEST TROY N. Y.—This gas-light company have declared a dividend of three per cent. for the last six months. The company's prospects are improving, and under the able management of Mr. Oswald, we look for an approach to par in the market price of its stock.

GAS-LIGHT ON SHIPBOARD.—The ship *Resistance* has lately been fitted up at Portsmouth, England, with an oil-gas apparatus. The manufacture of gas on board has, so far, been attended with less expense than the use of oil lamps, and at the same time there is no comparison to be drawn between the brilliancy of the gas over the dim and murky flame of the oil. Gallipoli oil was used to produce the gas, but it is calculated that petroleum could be advantageously substituted, the cost being much less, and the petroleum yielding a proportionately larger quantity of gas. An exchange says, that this apparatus, capable of supplying 24 burners, could be put up for about $140.

SAL-AMMONIAC FROM GAS LIQUOR.—To form the sal-ammoniac of commerce, the ammonial water obtained in gas-works is to be saturated with hydrochloric acid (muriatic acid.) It is usually evaporated in vessels of lead and then run into wooden coolers. The salt is then to be dried in stoves, and finally sublimed in iron pots with large domes.

PATENTS.

UNITED STATES

37,108.—S. J. Reeves, of Philadelphia, Pa., for an Improvement in Fagots for Wrought Metal Cannons, Hydraulic Pumps, &c.:

I claim the making of the bore on which the sheets are wound and welded of sufficient size to margin the bore of the gun when finished, substantially as and for the purpose described.

37,119.—L. C. White, of Waterbury, Conn., for an Improved fastening for Lamp Chimneys:

I claim, first, The peculiar construction of hawks-bill, B, or its equivalent, as shown in Fig. 1, Fig. 2, Fig. 3, and Fig. 4, and the mode of throwing it either backward or forward, and holding it in either position by means of the wire-lever, J, or its equivalent, the ends of said lever being loose in perforations h and k.

Second, I claim the middle projectile or tooth, f, or its equivalent, as shown in Fig. 1, Fig. 2, and Fig. 4, which throws the hawks-bill forward by gently pressing the base of the chimney upon it, independently of the upper projectile, e, which secures the chimney to the burner.

Third, I claim the position and the peculiar construction of the lever, J, or its equivalent as shown in Fig. 1 and Fig. 2, which throws the hawks-bill either backward or forward.

Fourth, I claim the hawks-bill, B, or its equivalent, in combination with the mode of attaching it to the burner without solder, by means of the bolt supports, d, formed in the shell of the burner as shown in Fig. 5, the whole being arranged substantially as and for the purpose herein described.

37,144.—Joseph Ridge, of Richmond, Ind., for an Improvement in Kerosene or Coal-oil Lamps:

I claim, first, The diaphragm, D, and cylinder, M, united in one piece of glass, substantially as represented, and constructed in the manner and for the purpose herein set forth.

Second, I claim the said diaphragm and cylinder, in combination with the base and metallic frame, support and guard, and short chimney, C, substantially in the manner and for the purpose represented by the drawing and model, and set forth in this specification.

37,152.—G. M. Cole, of Folsom City, Cal., for Mode of operating Railroad Pumps:

I claim the application of one or more cylinders, D, which are supplied with steam from the locomotive through pipes, c c', in combination with the pump, B, as and for the purpose shown and described.

37,167.—P. L. Howlett, of Springfield, Ill., for Apparatus for Distilling Alcohol:

I claim, First, the arrangement of one or more heating tubes, i, in the extractor, B, in combination with the still, A, and doubler, C, constructed and operating substantially as and for the purpose specified.

Second, The arrangement and combination of the compartments, f g h, in the extractor, B, pipes, a and b, heating tubes, i, still, A, doubler, C, worms, c and m, troughs, D and F, and pump, E, all constructed and operating as and for the purposes shown and described.

37,168.—Daniel Hunsicker, of Laurelton, Pa., for Water Motor:

I claim the endless chain provided with hinged floats and arranged to work over a rotating block, substantially as described.

And in combination with the endless chain and floats, I claim the guide rollers, M M, and guide pieces, N and P P, for the purposes set forth.

37,183.—W. S. Thompson, of Rochester, N. Y., for Spring Fastening for Lamp Chimneys:

I claim securing the chimney by means of the flexible, elastic wires, D D, on the opposite sides, suitably connected together, and having the portions, c c, resting respectively in the slots, a a, of the flange of the lamp top, in such a manner as to furnish an extended, continuous bearing on the base of the chimney to hold it centrally in place and allow it to expand freely and to adapt it to different sized chimneys, the whole arranged, combined and operating substantially as herein set forth.

37,192.—H. A. Alden, of Fishkill, N. Y., assignor to The New York Rubber Company, for Manufacture of Hose and Flexible Tubes:

I claim the herein-described process or method of water-proofing hose by internal application under pressure of such liquid or semi-liquid india rubber, gutta percha, or other cementing substance or compound as that, by subsequent exposure to air or heat, or by being otherwise treated, shall form a dry flexible coating impervious to water, and when so water-proofed, I claim the mode described of preserving the cylindrical form for the hose.

37,197.—D. E. Hall, of Brooklyn, N. Y., assignor to himself, Vasconcellos Houghton, Wm. A. Nichols and T. C. Sears, for Coal Oil Lamp:

I claim the fibrous mineral tip, i, prepared substantially as specified in combination with the wick, f, of fibrous material, as set forth.

I also claim the adjustable wick tube, d, in combination with the deflecting tube, g, for the purposes and as specified.

37,212.—Alfred Bliss, New Rochelle, N. Y., for a Lamp Insulator:

I claim an insulating collar of gutta percha or India rubber, constructed with an internal thread, b, to receive the burner, A, and an external thread, a', to screw into the socket, B, substantially as herein shown and described, and adapted to entirely prevent contact between the metallic surfaces of the lamp top and socket, as explained.

37,213.—J. E. Boyle, Brooklyn, N. Y., assignor to James Stevenson, New York City, for a Valve for Water-Closets:

I claim the hollow valve stem with its lateral induction and eduction water-ways, substantially as described, in combination with the induction valve, sliding piston and cylinder, provided with a small aperture or leak, to control the closing of the valve, and the diaphragm, or the equivalent thereof, for closing the valve by the pressure of the water alone, substantially as and for the purpose specified.

37,218.—J. D. Clark, Leicester, Mass, for a Bucket for Chain Pumps:

I claim a grooved bucket in combination with an elastic packing ring, as herein described, and for the purpose set forth.

37,220.—Joseph Dodin, Brooklyn, N. Y., for a Coal-oil Burner for Lamps:

I claim, first, The particular shape of the plate, Fig. 4, with its slots, a a, substantially as described.

Second, The circular plate, Fig. 5, with its slot, M, in combination with the movable tube, Fig. 3.

37,237.—Frederick McKee, Pittsburgh, Pa., for a Lamp Wick:

I claim as a new article of manufacture a lamp wick made out of pulp, and felted or hardened together, instead of being woven, plaited, or twisted, as herein set forth, and this I claim whether the pulp be encased in an outer protection or not, as described.

37,239.—T. J. Newland, Utica, N. Y., for a Railway Lamp:

I claim the tubes, B B', or their equivalents, constructed and operating substantially as described.

37,263.—W. G. Warden and Thomas K. Petty, Pittsburgh, Pa., for an Oil Still:

We claim the use in stills, for distilling hydro-carbon oils, of a double trap constructed substantially as herinbefore described, so connected with the still, z, its worm-pipe or goose-neck, as not to return to the still the heavier vapors or any condensed products of distillation, but so that any unvaporized liquid or solid substance, carried over with the vapor or boiling over from the still through the still-head or goose-neck, shall be arrested before reaching the worm or condenser, and either returned to the still or collected in a separate receptacle.

Also, Drawing off the unvaporized matter which is carried over from the still in the process of distillation and thereby preventing it passing into the condenser or receptacle for distilled oil by means of the apparatus, substantially as herein before described.

RE-ISSUE.

1,368.—W. L. Fish, Newark, N. J., for a Lamp Chimney:

I claim the use in connection with oil lamps of ordinary construction and operation, of heating vessels containing a central flue so shaped as to form the chimney of said lamp substantially as herein shown and described—whereby the same lamp may be used for both illuminating and heating purposes, or for either.

Second, In oil lamps of ordinary construction and in connection with the heating vessel before referred to, I claim the use of a bulb or its equivalent device for the intermediate support of said vessel by the lamp, substantially as herein shown and described.

Third, In combination with said heating vessel and bulb, when the latter is made of an opaque material, I claim the use of a window or of windows made of a transparent material for the transmission of light through it substantially as and for the purposes set forth.

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T. FARLEY,
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G. A. JEREMIAH,
Committee on Sewers.

OFFICE OF THE CITIZENS' GAS-LIGHT COMPANY OF BROOKLYN, No. 1 POST-OFFICE BUILDING, MONTAGUE ST., BROOKLYN, Dec. 29, 1862.—THIRD DIVIDEND.—A dividend of THREE PER CENT. on the capital stock of this Company has been declared, payable on and after the 15th of January. The Transfer Books will be closed from the 1st to the 15th of January inclusive. By order,

H. WARREN, Secretary.

OFFICE WILLIAMSBURGH GAS-Light Company, Brooklyn, N. Y., January 12th, 1863.—DIVIDEND.—The Board of Directors have this day declared a semi-annual DIVIDEND of FIVE PER CENT., payable on and after Monday next, January 19th.

The Transfer books will remain closed until the 20th. C. F. BLODGET, Secretary.

JERSEY CITY WATER LOAN Bonds.—Notice is hereby given that the Interest Coupons, due January 1, 1863, of the Jersey City Water Loan Bonds, will be paid upon presentation at the Ocean Bank, New York city, and the Bank of Jersey City, Jersey City. N. J.

G. S. BOICE, Registrar.

OFFICE OF THE WATER COMMISSIONERS, Jersey City, Dec. 20, 1862.

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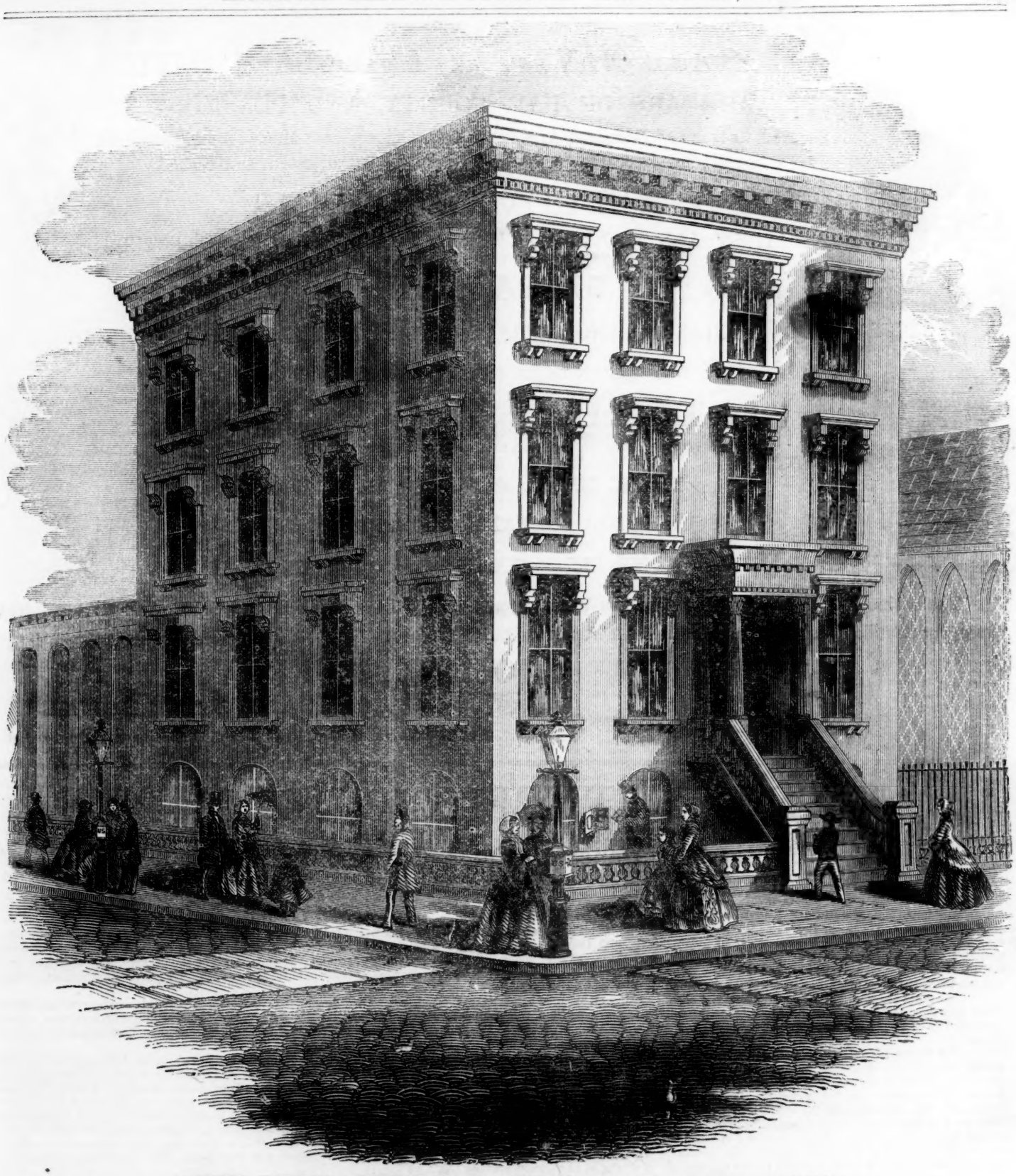

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This important inventio n, patented by Mr. Charles Newbold, and now for the first time introduced to the public, may confidently be stated to be one of the greatest interest and commer cial value, as the Patent Bituminized Pipes possess all the qualities necessary for the conveyance of Water, Gas, Sewage, Mine-Pumps, &c., viz.: great strength, great durability, and inoxidability, with the immense advantage of being about *one fifth* the weight of iron pipes, and about 35 per cent. cheaper; whilst, compared with lead pipes, the Bituminized Pipes are only about *one fourth* their price, without the possibility of the formation of the oxide and carbonate of lead, so dangerous for every purpose. They will stand 150 degrees of Heat, and after many trials it has been satisfactorily proved that rats or vermin will not touch them. They also withstand the action of all acids and salts.

Iron pipes are at present frequently covered with a coating of bitumen or coal tar before they are laid down; but the adherence of this coating to the metal being very imperfect, on account of vibration and the difference of expansion, this preservation is insufficient, besides being exposed to a number of influences which neutralize its efficacy—galvanic currents materially assist the formation of oxides and deposits, which cause the obstruction and eventually the destruction of metallic pipes.

The Patent Bituminized Pipes are neutral, non-conductors of electricity, and consequently are not exposed to any of the deteriorating influences mentioned above. The process of manufacture of these Pipes consist in causing a roll of paper to pass through a reservoir of melted bitumen, after which it is tightly coiled around a mandril to any required thickness; and thus, when hardened, a tube is formed of perfect texture, great hardness, and enormous strength. These Pipes are proved, by hydraulic pressure, to resist a pressure of 220 lbs. to the square inch, equal to 506 feet head of water, which is more than double the altitude of the highest reservoir. The bituminous composition which unites and covers these Pipes is so well known as an excellent preservative, that it will be unnecessary to demonstrate that, when laid underground, the durability of the Patent Bituminized Pipes may be considered as unlimited. The Pipes are made in lengths of seven feet, and are connected by socket joints of the same material as the Pipes; or they can be fitted with iron flanged sockets, screwed together in a most simple and inexpensive manner.

For Gas these Pipes are invaluable; the Gas-lining which we insert effectualy resists the action of Gas, and being non-conductors, there can be no condensation in them, and the joints made with the Patent Cement are so strong as to entirely prevent Leakage.

The cost of laying the Pipe is also small, compared with those of iron, and can be done by mere laborers. The Bituminized Pipes have been in use the last three years, for the conveyance of gas and have been ascertained to be as perfect now as when first laid down.

DIRECTIONS FOR JOINING THE PATENT BITUMINIZED PIPES.

Pack the pipes level in the ordinary way; slip the collar over one of the pipes; draw the ends close together and warm them by putting a hot iron between them; then press them together so as to make them adhere; take a piece of iron wire netting, about half an inch in the mesh, a little narrower than the length of the collar, and long enough to wrap once round the pipe, spread the collar over it and the joining; close the ends with clay; pour the melted cement into the manhole of the collar, and fill up the interior space; then remove the clay and the joint is finished.

It is necessary to leave a small vent hole in the clay at each end of the collar to allow the air to escape as the cement is poured in, that there may be no flaws or air bubles in it when cold. If in cooling the cement settles in the manhole, fill up again.

N. B.—The cement should be broken into small pieces and melted in a pot as you do lead, at a low temperature, until it is dissolved; it must be stirred while melting; then take it off and keep stiring it as it cools until it becomes nearly as liquid as water; then pour quickly.

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POTTS' REVOLVING SIGNAL LIGHTS,

PATENTED SEPTEMBER 8, 1857.

Mr. ALBERT POTTS, the well known Inventor of the LAMP-POST LETTER-BOXES, which have been adopted by the Post-Office Department for the large cities of the United States—and also of the GAS METER BOX, to be set in the front walls of houses, thus doing away with visits from Gas Inspectors, or burglars in gas-clothing, has lately brought forward a third Invention, which, in point of importance and world-wide usefulness, surpasses the others entirely.

These SIGNAL LIGHTS are intended for use on Vessels propelled by Steam, and those exclusively. They specially indicate the presence of a Steamer, and by their use there will be less likelihood of mistakes, and consequent collision, than at present. They are also intended for SIGNALLING AT NIGHT, and can be used for that purpose UNDER ANY CODE of SIGNALS NOW ARRANGED FOR FLAGS.

This Improvement in Lights for Steam Vessels consists in having the Lanterns containing the colored lights connected by means of a series of cogged gearing with some convenient part of the Engine or Machinery, so as to cause them to have a revolving motion around their axis. On side-wheel steamers, the Lanterns should be placed directly over the wheel-houses, and the power, or motion to turn them, may then be very conveniently obtained from the paddle-wheel shaft. On Propellers, the Lanterns should be placed on each side of the Pilot House, or hurricane deck, and the rotary motion derived from any convenient or suitable part of the Engine or Propeller shaft. Each Lantern is supported on the end of movable cranes, so that their relative positions may be changed and properly adjusted to suit the view of observers on either side of the vessel at the time of signalling.

The Lanterns to be used in this improvement may be constructed for Burning Oils, Fluids, Gas, or any of the known modes of illumination, and should be furnished with one or more lenses and reflectors, so as to concentrate the rays of light, and project them over the horizon with the greatest intensity. The lenses for this purpose should be made with colored glass, viz., Red and Green, and the position of the respective Lanterns, according to the color of the lenses therein, must be placed on the sides of the vessel so as to answer to the requirements of Rules and Regulations made and published by the Supervising Inspectors of Steamboats, agreeably to the Act of Congress of the United States in such cases made and provided. That is to say—by said Regulation—the Lantern having the green lenses for producing the Green Colored Light, must be placed on the starboard side of the vessel, and the other Lantern producing the Red Light, to be placed on the port side thereof. In pursuance, also, of the aforesaid Rules and Regulations, there is to be found in board and behind each Lantern, a screen to answer the purposes therein mentioned.

The cogged gearing, by which the Lanterns are connected with the Engine or paddle-wheel shaft, and thereby caused to revolve when the Engine is in motion, is so arranged that the connection may be readily shipped or unshipped, and the Lanterns made stationary or otherwise, at the pleasure of the Pilot, or those whose duty it may be to operate and attend to the same. The cranes on which the Lanterns are placed are also rigged so as to be readily turned horizontally from one position to another, so as to present one or both lights to the view of observers when laying athwart ships at the time of signalling.

On the Use and Application of the Improvement for Night Signals.

When the vessel is under weigh, or going ahead in its course, the Lanterns are to be placed directly athwart ships, so that such colored light therein will then have the position and place prescribed by Rule Seventh of the aforesaid Supervising Inspectors of Steam Boats, and with the screens behind them, as above described, will then answer all the intents and purposes for which the colored lights are thus required to be used, as illustrated in the several diagrams published by said Inspectors for the working of a system of Colored Lights. The Lights in this case, according to the color seen by the observer, indicate the course or direction of the vessel whereon they are carried. When the Lanterns with the colored lights therein, are made to revolve around on their axis, as proposed in this improvement, in addition to the signal above, another, and as we believe, very important and useful signal is thus formed, indicating that the vessel, whereon it is carried is a Steamer. In dark foggy nights, it is found by experience, to be somewhat of a difficult task to distinguish sailing vessels from Steamers and Propellers, especially when the latter are rigged, and carry a press of sail. When Steamers meet "head and head," it is the duty of each to pass to the right, or, on the larboard side of the other. Whereas, when a Steamer meets a sailing vessel, the former must give way and allow the latter to pursue its course. Hence, to carry out the regulations of the said Steamboat Inspectors, and prevent collisions, it is important to have some infallible sign, whereby the character of the vessel may be readily seen and determined. Several very fatal collisions have recently taken place through mistakes of this kind.

On Signals for Speed and Distance.

The gearing of the Lanterns with the paddle wheel or propeller shaft, may be so arranged as to be an index of their speed. A very good proportion, would probably be to make the Laterns turn about one third as fast as said shaft. Hence, when the speed of the vessel is previously known, when making a certain number of revolutions of the paddle or propeller, it becomes an easy task from observing the time with which the Lanterns thereon may be turning to approximate to the speed with which the said vessel is moving at the time of observation. Again, as the arcs described by the rays of light from each lantern, as they revolve around on their axis, is greater in proportion to the distance from said lantern, so will the time in which said rays move over any given space, be less in the same proportion. Hence, when the lights are very remote, or far off, from the observer, the duration of each column or cylinder, of rays from each lense, would pass the eye of the observer, in a short space of time, or with great velocity. Whereas, at a nearer point of observation, the time of its passage would be considerably lengthened, or the motion thereof apparently much slower. From these facts, we believe the improvement is susceptible of indicating, in an approximate manner, the speed and distance of vessels whereon the revolving lights may be used.

On the Application of the Improvement for Marine Telegraphic Purposes.

The Revolving Lights can be readily applied to the general purposes of Marine Signalling at night, as follows: In order to show this application, we have adopted the Numbers as given in Roger's Code of Marine Day Signals, believing that work to be somewhat of a standard in matters of this kind. Instead of the flags used in the above code, for day signals, to indicate the combinations of two or more letters of the Alphabet, which combination is referable to certain numbers indicative of the words or sentences telegraphed, we propose to perform the same operation, at night, by means of the two revolving colored lights, so as to indicate the numbers directly to which the intended words or sentences to be telegraphed are referable. Thus, whether the vessel to be signalled is ahead, astern, or abaft the beam, the position of the two colored lights must be so adjusted, by means of the moveable cranes, whereon said lanterns or lights are fixed, that the two lights may be fully made visible to the observer. When both lights are thrown into this position, stopping the motion of the lanterns may be the signal for calling attention, or a rocket fired off, or the steam whistle blown, would answer the same purpose. Now, in order to represent the ten numerals, we propose to indicate them by the respective motions of the two colored lights, as follows:

RED LIGHT.				GREEN LIGHT.			
One Red,	Represents	Number	1.	Two Green,	Represents	Number	2.
Three	do.	do.	3.	Four	do.	do.	4.
Five	do.	do.	5.	Six	do.	do.	6.
Seven	do.	do.	7.	Eight	do.	do.	8.
Nine	do.	do.	9.	One	do.	do.	0.

In the above arrangement, it will be seen that all the odd numbers are made by the Red Light, and the even numbers by the Green Light. In order to indicate the repeat of the last number, once or more times, or for other special purposes, which may hereafter be found useful and necessary, an even number of lights may be shown by the Red, and an odd number by the Green. It will be understood that when the Lanterns are made with three lenses in them, the numerals as above arranged are formed by the number of times a new light or lense is presented to the observer. Thus to indicate the number 3, the Red Light or Lantern would make one entire revolution; and to make the number 6, the Lantern carrying the Green Light would make two revolutions, and so on with the other numbers. When a symbol is made, the motion of the Lantern is to be suspended for a short time, and when a number expressing a sentence is formed, the lantern may be stopped for a longer period, or some one of the special signals above referred to, may be used for this purpose.

To show the application of this improvement as above mentioned, whereby these Lights can be used as readily for Night Signals, as Flags are used for Day Signals by the author of Roger's Code, we shall use the sign ○ colored red or green, according to the light used, to show the number of movements performed by the respective lights in order to represent any desired number of said code, suitable for the required purpose.

RED LIGHT.	GREEN LIGHT.
○, ○, ○, ○, ○,	
○, ○, ○, ○, ○, ○, ○.	
	○, ○.
	○. ○.

The above would represent the number 5722, and by reference to said Roger's Code, would be found to stand before the sentence:

"WILL YOU SHOW THE NUMBER THAT REPRESENTS YOUR NAME?"

RED LIGHT.	GREEN LIGHT.
○.	
○, ○, ○, ○, ○.	
○, ○, ○, ○, ○, ○, ○.	
	○, ○.

Here the number expressed is 1572, and per the same Code, stands for

"WHERE ARE YOU BOUND?"

RED LIGHT.	GREEN LIGHT.
○.	
○, ○, ○, ○, ○, ○, ○, ○, ○.	
○, ○, ○, ○, ○, ○, ○, ○, ○.	

The number thus expressed is 1928, and per said Code is

"WHAT IS YOUR CARGO?"

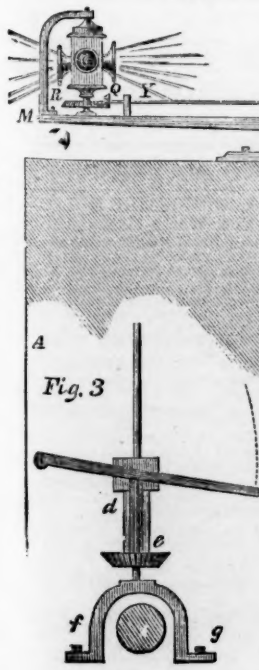
RED LIGHT.	GREEN LIGHT.
○, ○, ○, ○, ○.	
	○, ○, ○, ○, ○, ○.
	○.
○, ○, ○.	

Here the number expressed is 5603, and stands for

"HAVE YOU ANY NEWS?"

(RED LIGHT.)

Fig. 2



(GREEN LIGHT)

Fig. 1

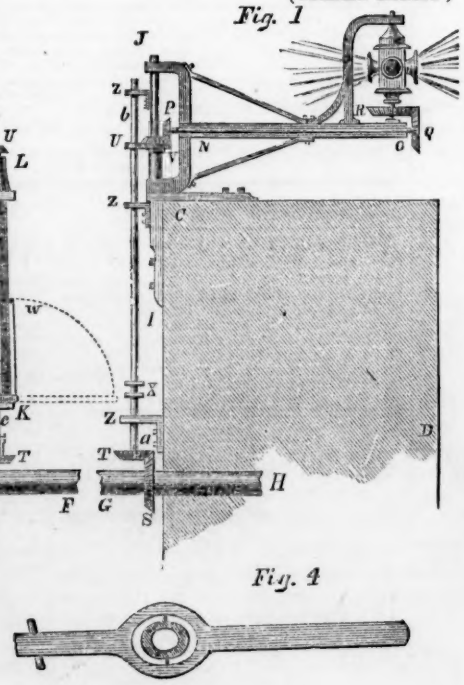


Fig. 4

MECHANICAL CONSTRUCTION.

In our engravings, Figs. 1 and 2, represent Vertical Sections through the wheel-house. In them E F and G H represent portions of the main Shaft. In Fig. 1, I J is a stout Iron or Wooden post, fastened against the side of the wheel-house, directly over the main shaft. On the upper part of this post, is fitted the moveable arm or crane N O, to the main shaft is fitted the bevel wheel S, and to the lower end of the rod a b, is fitted a corresponding wheel T. U is a small pinion on a b, which gears with the spur wheel, V, which in turns gives motion to the wheels, P and Q, and so revolves the lamp R. It will be seen that a Rotary motion is given to the lamp, when the main shaft is in motion and a b connected.

It can be disconnected by a lever, acting between the bosses X, which will elevate the rod in the guides Z Z Z.

Fig. 2 is another arrangement, for the same purpose. In this, K L represent a hollow Shaft, on which is firmly fastened, the arm L M, on which is the lantern. The hollow post is secured to the wheel-house by the straps K and B, and it can turn freely in them, the other part being the same in them as in fig. 1

The lever K W, when drawn down, will turn the frame in any required position around the Shaft c U. In fig. 1, the arm or crane N O, may be operated by cords from the wheel house, but in this device, the rod c U, does not lift up as in fig. 1, but in its place, the lower end is made square, and on it slides the short tube, d E shown in fig. 3. The lower end of the rod turns on a bridge, f g, spanning the main shaft. On the upper end of the tube, d e, a lever is attached by means of boxes and collars as shown in fig. 4. This lever when raised carries with it the beveled wheel T, thus disconnecting the gearing apparatus.

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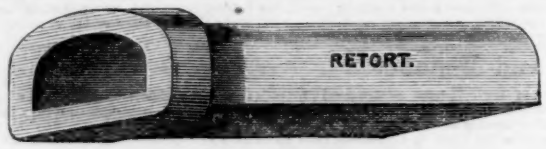

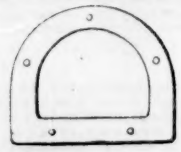

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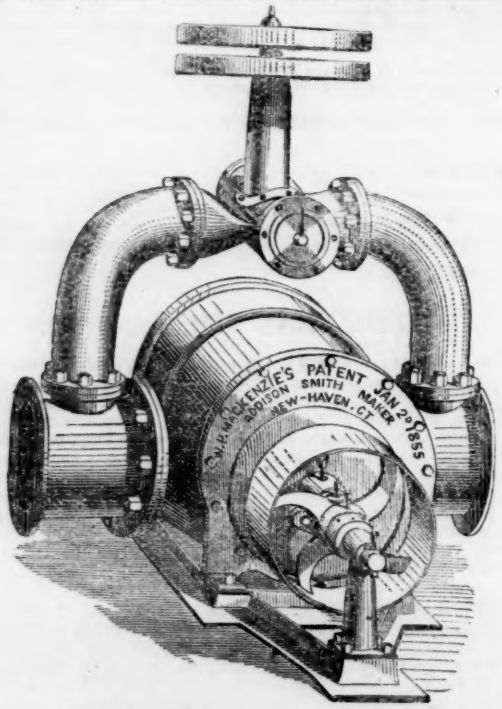

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